

The Conduct of the Air War in the Second World War

An International Comparison

Proceedings of the International Conference of Historians in
Freiburg im Breisgau, Federal Republic of Germany, from
29 August to 2 September 1988

Edited by
Horst Boog



BERG

New York / Oxford

Distributed exclusively in the US and Canada by
St Martin's Press, New York

McK
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785
.I 58
1988

STUDIES IN MILITARY HISTORY

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First published in 1992 by

Berg Publishers Limited

Editorial offices:

165 Taber Avenue, Providence, RI 02906, USA

150 Cowley Road, Oxford, OX4 1JJ, UK

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Library of Congress Cataloging-in-Publication Data

International Conference of Historians (1988: Freiburg im Breisgau,
Germany)

The conduct of the air war in the Second World War: an
international comparison : proceedings of the International
Conference of Historians in Freiburg 1. Br., Federal Republic of
Germany, from 29 August to 2 September 1988 / edited by Horst Boog.

p. cm. — (Studies in military history ; vol. 2)

Includes bibliographical references and index.

ISBN 0-85496-697-8

1. World War, 1939-1945—Aerial operations—Congresses.

I. Boog, Horst, 1928- . II. Title. III. Series.

D785.I58 1988

940.54'4—dc20

90-19960

CIP

British Library Cataloguing in Publication Data

The Conduct of the air war in the Second World War. —

(Studies in military history, v. 2).

1. World War 2. Air operations

I. Boog, Horst II. Series

940.544

ISBN 0-85496-697-8

Printed and bound in Great Britain by
Billing and Sons Ltd, Worcester

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Preface

The Militärgeschichtliches Forschungsamt is pleased to present the results of the international conference of historians on 'The Conduct of the Air War in the Second World War. An International Comparison', which took place in Freiburg im Breisgau from 29 August to 2 September 1988. It is hoped that this publication will contribute to an objective analysis of that unique phenomenon, a long and massive air war between highly industrialised nations, with all its implications for society, the economy, politics and the command of military operations. The contributions from so many well-known scholars and experts in aviation, air war, economic and general history from almost a dozen countries are gratefully appreciated as an expression of the international reputation achieved by this institute through the work of its members and its publications in the thirty years of its existence.

This publication may also be regarded as a valuable supplement to the series 'Das Deutsche Reich und der Zweite Weltkrieg' being published by this institute, which on account of the many subjects it covers and its Germanocentric nature, and despite its consideration of war in the third dimension, cannot possibly give a minute account of all the aspects of the air war in the Second World War that are necessary to understand it fully. The Militärgeschichtliches Forschungsamt would be pleased if this book brings to light new perspectives and adds to existing knowledge of the air war and the Second World War.

Dr Günter Roth
Brigadier General
Head of the Militärgeschichtliches Forschungsamt

Acknowledgements

This publication would not have seen the light of day, had the international conference of historians on 'The Conduct of the Air War in the Second World War. An International Comparison', held in Freiburg from 29 August to 2 September 1988, not taken place. I should like to begin by expressing my gratitude to those who helped organise the meeting. I am indebted to the management of the French Grand Hotel in Freiburg and to the Commander of the French Third Armoured Division, General Voinot, for their kind permission to use the banqueting hall and other facilities of the hotel for the conference. In particular, the services of the French Liaison Officer, Lieutenant-Colonel Ulm, were invaluable. The rectors of the University of Freiburg, Professor Dr Rüdhardt, and of the Freiburg Teachers' College, Professor Dr Schwark, as well as the Head of the Studentenwerk, Herr Dr Müller-Klute, deserve special mention for their willingness to provide the facilities of their institutions for our use. My thanks also go to the Commander of the Reconnaissance Geschwader 51 'Immelmann', Colonel Back, whose invitation to the participants to visit his establishment added a particularly interesting aspect to the programme.

The organisational skills and the efforts of the Administration of the Militärgeschichtliches Forschungsamt, under Oberstleutnant Fuss assisted by Oberbootsmann Schiel, Hauptfeldwebel Flutura, Stabsfeldwebel Wagner and Mrs Dufner, whose indefatigable efforts in dealing with the paperwork and correspondence were much appreciated, and the linguistic assistance of Mr Keenan, were an invaluable contribution to the solution of all the problems connected with speakers' accommodation, the excursions, and all the other organisational problems involved. The translators of the Bundeswehr Administrative District (Wehrbereichsverwaltung) V in Stuttgart, under Regierungsdirektor Mühl, deserve special thanks for their punctual translation of the papers in three languages. This was an

Acknowledgements

extraordinary achievement and a fundamental prerequisite for providing all participants with advance information about the topics to be discussed, thus enabling them to follow and contribute to the multilingual debates. The success of the international conference depended entirely on the ability of the four interpreters, Mr Mühl, Mr Blumenberg, Miss Preusche and Mr Gerhard to interpret simultaneously the papers and the ensuing discussions. They did an excellent job, which was highly appreciated by all the participants. Last but not least, I am particularly grateful to the Fritz Thyssen Endowment in Cologne for financial support, which helped to cover a large portion of guest speakers' expenses.

The preparation of the proceedings of this air power conference for print was in the hands of the Head of the Editorial Section of the Militärgeschichtliches Forschungsamt, Dr Michalka, who was ably assisted by the German copy-editor, Mrs Schwind. The maps were drawn by Miss Dittel. The members of the MGFA Translation Section with Mr Keenan as chief and Mr Fry and Miss Schulz assisted in the preparation of the manuscript of this English-language version of the conference proceedings. The graphs and organisational charts were done by Mrs Marshall. Mr Raedisch deserves special mention for the bibliography. The final draft was prepared with admirable accuracy and patience by Mr Tiernan of Berg Publishers. Again many thanks to all those whose assistance enabled us to stage this conference and to publish the English version of its proceedings.

The views expressed by the different contributors are not necessarily those of the editor.

Introduction

Horst Boog

The following chapters are the results of the first international conference on air warfare held under the auspices of the Militärgeschichtliche Forschungsamt. Unfortunately it turned out to be impossible to get accounts of experiences from former high-ranking Luftwaffe veterans of the Second World War. The intention is to provide sufficient material for a worthwhile international comparison. This provoked some criticism about the relatively small number of German contributions on the Luftwaffe. But Germany was only one of seven major air powers to be compared with each other here. It should not be forgotten either that the history of the Luftwaffe has been the subject of many publications throughout the world, and that several more contributions on the German Air Force were written by foreign historians. All this is not surprising, as there are many more foreigners than Germans specialising in the historiography of German air warfare in the two World Wars. Germans can benefit a lot from listening to what foreigners have to say about the old Luftwaffe, and this has generally been considerate and fair.

It is regrettable that there are not more air war specialists at German academic institutions. There are two reasons for this. Firstly, military history was banned from German universities, which is an understandable reaction in a country that has lost two World Wars. Secondly, a new approach to the writing of military history was adopted, getting away from the old-style history of warfare (*Kriegsgeschichte*), which quite often amounted to no more than a chronicle of operations or mere hero-worship, or from the subsequent *Wehrgeschichte*, a history focusing on the art of war as an application of science and politics. The new approach took a critical look at the interaction of military with social, political and economic history. There was every good

reason why the old-style history of warfare fell short of a global perception of this strategic interaction and led inevitably to a limited historical perspective with all its negative consequences.

Perhaps the pendulum did swing a little too far towards general history. Those who wished to gain admittance to academic circles and make a career as military historians were well advised to don the guise of general historians. Those interested in operational history were regarded as being in an ivory tower, and who wanted that reputation? Sometimes it seemed as if the nineteenth-century scholastic quarrel between proponents of a classical education and those favouring a more specialised technical education had re-emerged. In this connection it goes without saying that the work of general historians paints a less than complete picture that is consequent upon a lack of detail and specific references. Perhaps in this quarrel too much emphasis was placed on the neo-classical ideal of the all-rounder. There was a similar dispute over the recognition of civilian and military engineers by the regular officers of the old Luftwaffe; it went on for years and was still unsettled at the end of the war. The former were regarded as specialists, whereas the latter were considered versatile in the spirit of the ideals of the neo-classical education adopted by the military in the nineteenth century. Of course, this proved to be more of an illusion than anything resembling reality.

The replacement of authoritarian leadership, a perversion of the classical ideal of the all-rounder reinforced by the Nazi *Führer* principle, by a kind of joint leadership, wherever this proved possible in the military, was eventually doomed by the failure to grant technicians, engineers, scientists and civilian specialists in general equal status with the officers. After the war, the atmosphere in the world of military historiography was, however – not without some justification – not conducive to the training of historians specialising in aviation and air warfare. In 1972, in an effort to break with the tradition of specialists, the MGFA replaced the land warfare, naval warfare and air warfare divisions working alongside the general history divisions with a new system of specialist officers for army, navy and air-force history. In implementing this separation general historians ultimately blocked their own access to the more specialised fields of study which are an essential element of modern military history. The historians became part of a pool, from which they were assigned to teams working on a variety of projects. The intention was that, after familiarising themselves briefly with a par-

ticular subject, historians should be able to write on a variety of topics, switching sometimes from one day to the next from political history to economic history, and so on. Of course, it is important for historians not to neglect general history, irrespective of their specialisation. However, the working method just described could lead to amateurism. By now it has become clear that specialists are indispensable, and thus one can assume that military history and its specialised fields of study will soon again become a recognised discipline, just like political, ecclesiastical and social history.

Developments in foreign countries, where there has also been a certain disdain towards military historians on the part of general historians, are encouraging. Today, military history is taught at some two hundred American colleges and universities, and in England well-known military historians hold renowned chairs at famous universities. Six years ago the Chief of Staff of the French Air Force announced that chairs or perhaps even institutes of history for both air warfare and naval warfare would be established at the Sorbonne. It is believed that military history, on the basis of its achievements, should also become a regular feature of university curricula in Germany, although such a step would meet with political opposition. But the attitude of many Germans towards military history, which has been marked by the trauma of the Third Reich, should gradually be superseded by the realisation that military history in its present form is a discerning academic discipline helping to broaden our knowledge of general history, and not, as some would see it, an ingredient in the concoction of another war.

The comparative approach to the history of air warfare in the Second World War could hardly illustrate better the nature of the modern critical writing of military history, because, as Richard J. Overy put it, an air force was for every nation that possessed one a symbol of modernity, the embodiment of its advanced level of industrialisation, and thus a reflection of comparatively modern social structures. Air-armament expenditure was a top priority in most industrial countries, providing a large number of jobs in research and in industry, and placing a heavy burden on national economies. The air forces themselves, especially their bombers, with their ability to span continents and reach cities and their populations far inland, exercised considerable influence, both positive and negative, on social, political, economic and industrial systems.

As a subject, therefore, air warfare in the Second World War

could not be better suited to the modern-day approach, which attempts to place military history in the context of contemporaneous political, economic and social issues, especially if a comparison of corresponding developments in other countries is attempted, as we set out to do here. It is hoped that the following articles not only clarify specific phases of the development of air forces, but also enable the reader to explore the reasons behind some major military decisions and operations and, in addition, shed some light on the organisational and command structures of the various air forces, which were the cornerstone of their decision-making process, and thus provide the basis for our comparison. A distinction must be made between these structures, which are determined by the prevailing social and political order or by the personalities and technology of the day, and the effect of the force of circumstances, which may, however, also be consequent upon a particular political system. Finally, the international comparison should provide criteria for a fair assessment of the part played by the various nations in their respective successes and failures, and encourage an understanding of the evolution of aviation and air warfare which transcends bloc boundaries, and should also deepen mutual understanding of the development of the national air forces within the NATO alliance. It should be borne in mind that the task of historians is not to deliver verdicts, but to analyse and understand— which does not necessarily mean approve of — events as they occurred.

PART I

Air Warfare and Modernity



1

Air Power in the Second World War: Historical Themes and Theories

Richard J. Overy

Air power before the Second World War was a largely unknown quantity. Contemporaries were deeply divided about its real significance; even the staunchest supporters of air power recognised 'that air power has not proven itself under the actual test of war'.¹ There were those like the American general, Billy Mitchell, who argued that air power was the single most important factor in modern warfare: 'The influence of air power on the ability of one nation to impress its will on another in an armed conflict will be decisive.'² The 'modern' nature of air power matched the current strategic conception of total war. After the conflict of 1914-18 strategists assumed that Great Power conflicts would involve the total commitment of resources to warfare, and hence that the enemy economy or the morale of his people were legitimate targets for attack. Air power would bring war to all citizens, not just the armed forces. 'It will mean', wrote the French General Duval, 'not so much a war of armies as it will mean a struggle of nation against nation.'³ In this sense air power would make warfare a test not merely of battlefield skills but of economic strength, social integration, and moral resilience.

It is easy to see why air power assumed these dimensions both in strategic theory and in the popular perception of warfare between the World Wars. The threat of destruction from the air had an almost mythical power; and the pace of aviation technology and destructive power was changing so rapidly that the science-fiction image of air power was demonstrably becoming operational reality. The feebleness of civilian morale when faced with the stark reality of death from the skies was accepted as

common knowledge, though there was little hard evidence to support it. Air attack on its own could, in the words of a senior American air officer, 'compel an enemy to submit to the will of his opponent'.⁴

Such a view was based on the uncritical assumption that domestic crisis could force military surrender, that, in an age of mass politics, the people made war and ended it; and on a second assumption that other, enemy, races were, in Lord Weir's graphic phrase, 'susceptible to bloodiness', that their morale would crack first.⁵

Of course this apocalyptic vision of air power was not shared by all, and some of the best recent history of air power has illustrated the deep doctrinal divisions that existed within the armed forces about the place and nature of air power in overall strategy. There were few military or naval leaders who would have agreed with Sir Henry Norman's judgement in 1918 that 'the one and only field where operations upon a vastly extended scale and upon new strategic principles are possible, is the air';⁶ and many who might have echoed the view of the American General Embick, expressed in 1935, that 'the role of military aviation must by its inherent nature be essentially of an auxiliary character'.⁷ Embick's General Staff colleague, Colonel Krueger, contributed to the argument the following attack on the champions of air power.⁸

They neither dream nor think out their proposals to the point of practical application; they merely make assertions that will not stand the test of serious analysis. Sanity should and must prevail in this matter. Aircraft are admittedly powerful agents of destruction, but their power is curtailed by their inherent limitations. Heavier-than-air craft are not self-sustaining and air forces are therefore dependent upon land and sea forces for means of transportation and for support.

Here in this American debate in 1935 were expressed the classic objections to the 'war-winning' view of air power: that air power is essentially auxiliary to the other services, and that the exercise of air power can only be undertaken as a function of combined operations in pursuit of the general mission of the armed forces.

These central arguments coloured the development of air doctrine and air force structure before 1939, and the strategic options available to air forces when war broke out. It was a distinction that divided air forces as well, for not all airmen shared an uncritical faith in air power as either an independent

or a war-winning instrument. For the majority of the air forces that fought between 1939 and 1945, air power was a dimension of combined operations, and aircraft were used tactically. The tactical objective might well be achieved by independent operations (the fight for air superiority against an enemy air force, for example), or with air forces enjoying organisational autonomy; but the classic principle of warfare, the defeat of the enemy forces in the field, dominated the exercise of air power much more than the 'air-minded' generation of 1918 assumed.

These contemporary divisions have coloured historical perceptions of air power too, about how much air power mattered in explaining the outcome of war. Much of the history of air power has, consciously or otherwise, measured the historical outcome against some kind of putative ideal of air power, that aircraft ought to have been an independent war-winning weapon, used in the right way. The performance of an air force is then measured against the ideal, and the resulting gap explained in terms of deficiency and misjudgement. This is evident in the history of strategic bombing. Much of the debate about the nature of air power hinges around analysis of the effectiveness of bombing campaigns, with the implicit assumption that bombing was the form of air power that really mattered during the war. The 'success' of an air force is then measured against how aware and prepared it was for the strategic bombing mission. Naturally there is a powerful contrary view: the moral revulsion against bombing, its prodigality in the use of resources and its indiscriminate victimisation, have contributed to an assessment of bombing that has underestimated the impact that bombing actually had on the economies and societies that experienced it.

The issue here is not so much the efficacy or otherwise of bombing, but the extent to which air force history is restricted by asking the questions about air power this way round. The question that should really be asked is why, in the face of great expense, lack of combat experience, strategic confusion and tactical ignorance, two states, Britain and America, embarked on strategic bombing campaigns at all. For recent research on the French, German and Soviet air forces makes it clear that it was not doctrinal conservatism or military self-interest that prevented the development of strategic bombardment at the core of their air forces, but a rational evaluation of the direction in which air warfare and air technology were moving. French air strategists and Soviet air generals explored the strategic options,

strongly influenced by the air-combat lessons of Spain and China. They arrived at the not unreasonable conclusion that the development of more effective air defence and faster fighters, the importance of providing aerial cover over surface forces, and the necessity of defeating the enemy air force, all meant that the most cost-effective use of air power lay in battle-front tactical operations.⁹

Once air-power history has ceased to be dominated by bombing and the alleged failure to mount strategic bombing campaigns, there are important questions that can be asked about other forms of air power, which recognise some of the essential limitations in the use of aircraft during the war. It is entirely appropriate that the framework should be comparative. That is not to deny that air power has its own history for each individual air force; but only through a comparative perspective is it possible to identify and define the major themes with which the history of air power can be approached. Air power in the Second World War was defined by a range of 'conditioning factors' which reach back well before the outbreak of war itself. These factors did not completely determine the outcome, for the course of the war produced unanticipated developments; but the nature of air power was such that the whole structure and doctrine of an air force, and its central weapons systems, took time to evolve, and could not be altered quickly or substantially during the war. The pre-war evolution of air forces in this sense did crucially condition the role played by air power and the actual conduct of air warfare. Finally it has to be recognised that the nature of air power was such that there was only a handful of states that could hope to exercise it with any effect, just as today the club of nuclear powers is necessarily constricted. Though it is an obvious point to make, air power did require a level of economic, technical and organisational development which favoured *a priori* the larger and more advanced states, and permanently inhibited other states – China or Poland, for example – from developing effective air power.

I: Factors Conditioning the Evolution and Use of Air Forces

There were five major factors that conditioned the evolution and use of air forces: strategic conception, economic capability, scientific and technical mobilisation, political and social reception and

combat-effectiveness. Not each factor had the same weight or produced the same results in every state, but all critically conditioned the ability of any air force to prepare for air warfare and to exercise air power. These themes provide an analytical framework for understanding the different circumstances and historical forces that shaped the use of aircraft in particular states, and set the parameters for any discussion of comparative air power.

1 Strategic Conception

The most fundamental factor determining the use of air power was its place in general strategy, and the evolution within an air force of doctrine for aerial warfare. This was not, as might be assumed, an automatic process, arising from the mere existence of the new weapon, but developed dialectically with the development of naval and military strategy, in such a way that air doctrine could be integrated into the wider battle plans and the general aim of the armed forces as a whole. The strategic conception in turn determined the force structure, organisational shape and tactical preferences of the force. Despite the fact that air technology and strategic thinking on air power were both effectively international before the war, the strategic conception differed widely between air forces. In large part this could be attributed to differences in geopolitical circumstances or foreign-policy intentions. Air power in the United States, for example, was critically conditioned by geopolitics. Low priority for air forces in the 1930s reflected the prevailing view that no major potential enemy could reach the continental United States from existing bases, and that American peaceableness rendered an offensive air force redundant. By 1940 that isolation had disappeared. As Roosevelt told Congress in May 1940: 'The Azores are only 2,000 miles from parts of our eastern seaboard and if Bermuda fell into hostile hands it would be a matter of less than three hours for modern bombers to reach our shores.'¹⁰ This change accelerated the American development of air power and the birth of a large counter-offensive air force.

These wider issues explain the French and German preference for tactical air forces protecting their large continental armies; or the Japanese emphasis on air-sea co-operation to make up for the problems of geography in the southward advance; or the British hope that air power would make unnecessary a large expeditionary force, because bombing would be a cheap and effective way of defeating any European enemy by attritional

blockade or by a 'knock-out blow'. But the strategic conception also depended on the strategic preferences of the armed forces, which rested in turn on such factors as the degree of autonomy enjoyed by the air force, the extent to which airmen had access to central strategic decision-making, and the prevailing doctrinal framework. There were plenty of American air leaders who favoured a greater commitment to air power in the 1930s; but they were compelled to work within a doctrinal framework acceptable to the army and navy, and to an isolationist Congress. By understanding the limitations imposed by intellectual assumptions or organisational constraints it becomes easier to explain the different ways in which air power was perceived and exercised, and also to accept that there was no optimum or universal way in which air power could be realised. The strategic conception of air power was rooted in widely differing historical circumstances, and in the preferences and prejudices of the strategy-makers themselves.

2 *Economic Capability*

If strategy is the primary arena for understanding the evolution of air power, the choices that were made were critically conditioned by economic possibilities. That this was so derived from the nature of the weapon itself. The aircraft was a large, expensive and complex engineering product, and, unlike naval craft, had to be procured not in tens but in thousands to perform adequately the range of strategic tasks assigned to it. The question of economic scale was very much influenced by the experience of air warfare in the First World War, where the length of the front and the size of the armies dictated the volume of aircraft production.¹¹ The belief that air power was determined by the scale of surface forces meant that in effect it could only be pursued by those states with large and advanced industrial bases, with access to adequate raw-material supplies and sufficient quantities of skilled labour.

In all the major combatant powers the aviation industry became the single largest manufacturing sector, and the air force took between 40 per cent and 50 per cent of the resources devoted to war production. The range and scale of industrial resources ruled out all but the major powers from competing in the air, and even states with a sizeable if recently developed industrial core, Italy or Japan, lacked the depth of industrial development and access to materials to be able to produce

aircraft in numbers to match Germany, Russia or the United States. Of course the mere existence of resources was not enough. The economic effort in the air depended on the willingness of governments to devote resources on this scale, the ability to mobilise industrial resources effectively (which required a high level of organisational competence and satisfactory planning skills and experience), and the co-operation of both labour and the business community in sustaining the aircraft-production effort. None of these factors could be taken for granted, for in this case economic success rested on wider evidence of modernisation in administrative procedures or planning capabilities and on the effective integration of planners, soldiers and producers. Production planning also rested on good economic intelligence: on knowledge of what other powers were producing, or were capable of producing. It was important to understand the economic factors conditioning enemy air power, since this provided a further set of parameters for deciding on domestic priorities.

3 Scientific and Technical Mobilisation

Closely linked with the mobilisation of economic resources was the state of scientific and technical knowledge and the extent to which this, too, could be mobilised in helpful ways to serve air power. This was not a straightforward issue either, as the histories of air technology make plain. Technological mobilisation conditioned the quality of the resources used in air fighting, and was particularly important for the period in question because in the mid-1930s began a period of technical transformation for air power which continued on into the age of jet fighters and missiles. This transformation not only affected the chief weapon, the aircraft, which changed from a slow wood-and-fabric biplane to a fast all-metal monoplane, but also its armament and payload and operational equipment. Science contributed in other ways as well: in the development of anti-aircraft defences, in radar and radio communications and navigation, in better materials and better bombs.

So rapid were changes in the scientific and technical field of aviation, that the mobilisation of science produced problems of a quite different order involving the integration of a shifting and unstable variable into a process of rigid scheduling and production planning. Technological obsolescence and technological initiative conditioned air power in all sorts of ways. Scientific

intelligence made possible the conduct of strategic operations previously inhibited by technical inferiority; technical modernity altered entirely the conditions of air combat. Science and technology both required a broad-based and extensive technical and scientific establishment, and the effective integration of those resources with the air forces and the aircraft producers. How effectively this was done again depended to some extent on a question of sheer resources, but it also depended on producing a satisfactory environment for experimentation and an effective framework for innovation. And above all it rested on the ability of the armed forces to accept and work with scientists and engineers, and to find a way of communicating what they needed and using what they were given. Despite the advances made during the First World War, this was still a difficult relationship, compromised by professional jealousies, military protocol and the inherent complexity of the issues at stake in scientific and technical procurement. It is a testimony to how arbitrary this relationship could be that so many technical breakthroughs were exploited by chance or luck as much as through the establishment of successful evaluative procedures.

4 Political and Social Reception

Correct strategy and adequate resources were not effective in themselves divorced from the broader framework of what might be called 'air-power politics'. In the broadest sense, air power needed the support and understanding of the political leadership. Air forces benefited or suffered from the degree of 'air-mindedness' of the political élite they served, and indeed of the wider public too. In Britain air power was widely supported throughout the political and bureaucratic establishment, and enjoyed the support of the pre-war Prime Minister, Neville Chamberlain, who thought aviation 'of first-rate, if not decisive importance'.¹² Roosevelt shared this enthusiasm for air power, as did Churchill, the champion of air rearmament in the 1930s. It is almost inconceivable that either Britain or the United States would have launched the bombing offensives against Germany if either leader had strongly opposed the strategy. Yet the political climate was not always so favourable. In France part at least of the conflict between the army and the air-force enthusiasts around Pierre Cot derived from the curious belief that independent air power was a Bolshevik aim, designed to under-

mine the historic role of the land army.¹³ In the Soviet Union the development of the Red Army air forces in the mid-1930s was seriously affected by the purges and the revolution in air strategy authorised by Stalin himself.¹⁴ Air power was never independent of these pressures, and because of its expense and complexity, and its key place in both strategy and even foreign affairs, became inherently a political issue.

The political dimension intruded even more clearly in the conflict between the three major services. Inter-service rivalry was not merely a conflict over doctrine, but involved the political self-interest of each branch. The more stridently air-power enthusiasts challenged the old forms of warfare, the more prejudice and political hostility coloured the response of the navy and army to air power.¹⁵ The French army suspected the communistic sympathies of the air force in the era of the Popular Front; Admiral Moffet accused Billy Mitchell of using 'the revolutionary methods of the Communists' in promoting air power in the 1920s.¹⁶ Any understanding of the development of organised air power cannot ignore the political framework within which it operated, and the nature of its political reception. Air power raised questions about modernity in warfare in obtrusive ways: aircraft, like tanks, forced the pace of technical modernisation in the armed forces, and it should not surprise us that this was an uneven and politically-charged process. The nature of the new weapon also demanded the social modernisation of the forces themselves; cavalry officers in Germany found themselves in charge of air fleets; air force officers had to accept close co-operation with industry and civilian officials, and all air-force personnel had to have a higher level of technical knowledge and training than their counterparts in other services. This produced tensions of a different kind, for it challenged the monopoly of military skills enjoyed by the army and navy, shifted the social structure of the forces (it is significant that most of the air force stayed loyal to the Spanish Republic in 1936), and speeded up the professionalisation of the military establishment.

5 Combat-effectiveness

Finally, air warfare was conditioned by the ability of air forces to organise and use the resources they were given within the strategic guidelines. Here the skills required were as much managerial as fighting skills, for air forces required a very large managerial organisation in relation to the actual combat forces involved,

which, unlike armies or navies, numbered only thousands rather than millions. Combat-effectiveness was a direct function of the organisation of air forces both in terms of the facilities (bases, service organisation, technical services) and the actual disposition of an air force (air armies, air fleets, combat commands, etc.). The distribution of air forces was related closely to the way air power was perceived; combat-effectiveness meant different things for the Eighth Air Force than for the tactical air units fighting on the eastern front. At the core of effective organisation was communication and command structure. The air force operated over very wide areas and at great speed, and the very nature of air operations, using a small number of highly specialised units for the precise location and destruction of targets, required a flexible and effective means of communicating between units and the central controller. Sheer weight of aircraft numbers was not a sufficient guarantee of effective air fighting, as the Battle of Britain and the first months on the eastern front made clear.

Combat-effectiveness was also conditioned by training and the supply of pilots. This was again an organisational question of great significance, for high levels of aircraft output had to be matched by a regular supply of highly qualified men to fly them. Each pilot required a higher level of training than officers in other forces, and undertook a highly specialised and expensive form of combat. In turn, the training he received called for a clear appreciation on the part of air-force leaders about what they wanted the air forces to do. This was a difficult position to achieve, for air tactics changed under conditions of combat, and fighting power depended on the ability to grasp and communicate basic tactical skills together with the changes learned from combat experience. Training methods and tactical doctrine were by no means the same in each air force, and preparation for combat could, and did, influence the relative effectiveness of air forces. Both deserve greater academic attention than they have had hitherto.

Combat-effectiveness also depended on a wide range of other criteria. An air force required a large number of specialised bases and an army of skilled service personnel. This brought problems of its own, since the skills required of air technicians were often the same skills required at home in the arms factories. The lack of adequate numbers of skilled mechanics at air bases and depots was a serious constraint for any air force, and led in the war to widely fluctuating rates of serviceability between air forces, or in the same air force at different times.¹⁷ The high rate

of combat attrition placed a premium on good maintenance and rapid repair of damaged aircraft. As the war developed an attritional character in the air, the issue of reserve-building and the effective calculation of wastage rates assumed a real importance; reserve-building and logistical organisation became significant dimensions of air combat. So, too, did air intelligence, some of which was devoted to just this question of estimating loss-rates through operational research. Combat-effectiveness depended on scientific intelligence in radar and the radio war, and on intelligence which evaluated and defined air targets. This was as important in day-to-day combat as it was in strategic bombing when it came to choosing targets; but in a wider sense intelligence on the enemy economy defined the whole nature of the strategy of the air offensive. The RAF framed its bombing plans around the pre-war knowledge of Germany's 'organised systems of production, supply, communications and transport', the 'nerve centres, main arteries, heart and brain' of the German national effort.¹⁸

II: Military, Economic and Social Consequences of Air Power

These five factors provide a framework for analysing the nature and development of air power. But they are essentially conditional elements, defining possibilities rather than outcomes. To understand the significance of air power in the Second World War it is necessary to know not only what conditioned the history of air power, but what its impact was on the course of the war. Here the themes are fewer, though no less complex: the impact of air power on the conduct of the war; the effect of air power on the economy; and the social consequences of air power.

1 Air Power and Warfare

There can be no unambiguous answer to the question about how important air power was in explaining the military course and final outcome of the war. The negative view that without air power victory would certainly have been impossible is perhaps commonly held. But there is much greater controversy over the question of whether air power was decisive, the factor that made the difference. It is inherently difficult to answer the

question this way, because for most of the war combined operations using tactical air power were the major arena for air fighting. Air power was inseparable from the role of the army or navy, and it was significant to the extent that it protected, expedited or permitted surface operations. Absence of tactical air power severely restricted the activities of surface forces, but we cannot be entirely certain that, for example, the huge resources devoted to aircraft production in Germany in 1943-5 would not have been better used producing thousands more tanks and releasing more men for the front. Bombing strategy has attracted the same counter-factual argument, that without the massive industrial commitment and organisational demands of the bombing campaign, Britain might have made much better use of its resources for war, with larger armies, more tanks, more shipping. These arguments certainly raise the question about whether the strategic or tactical gains from air power were really commensurate with the resources devoted to it; but the answers are speculative rather than historical. The commitment to air power arose from pre-war perceptions about modern warfare, and if aircraft did not develop into the war-winning independent weapon of air-power theory, they did indeed prove to be an ingredient without which final victory would not have been possible.

This emerges more clearly when the contrasts between the strategies of the major powers are examined. There was an evident distinction between the Axis and Allied use of air power which became more marked as the war went on. The Axis powers emphasised offensive aviation, high aircraft quality or high standards of pilot-training and combat-effectiveness, but confined the air effort, partly through strategic preference, partly through the influence of the army or navy on the conduct of the war, mainly to operations in support of surface forces. This brought immediate gains in western Europe, in the Pacific and in south-east Asia, but at the expense of defence aviation, or strategic bombardment, or, in the German case, a serious commitment to air-sea co-operation.

The Axis powers also placed greater emphasis on tactical questions, on effective air fighting, which gave them great advantages in terms of actual combat (for example, the success of a limited number of fighter aircraft against the bombing fleets in 1943), but they devoted less effort to organisation and supply, to the non-operational aspects of the air effort. By contrast the western Allies devoted a substantial part of their air effort to

bombing campaigns, to organising air defence, to extensive air-sea co-operation, and to the supply and development of resources. Under conditions of war they were compelled to devote increasing effort to tactical aviation and counter-force strategy, to the idea of winning air superiority over the fighting front. But in the early stages of the war all three major Allied powers had a low level of combat effectiveness, which slowly improved under the actual experience of air fighting. Each area of the air effort complemented the others; a general air strategy gave the Allies a degree of flexibility, a room for manoeuvre that the Axis powers lacked, and a lead that was difficult to erode. When Germany finally did build up large air-defence forces and secured large-scale aircraft output in 1944, it was rendered ineffective by the numerical superiority and bombing strategy of her enemies. This was the outcome of contrasting experience in the air war: the Allies' strategic goals made it necessary to develop much greater combat-effectiveness, but the high combat-effectiveness of German or Japanese forces disguised the need to broaden air strategy until it was too late.

Of course the wider issue of strategic choices says nothing in itself about the nature of air combat, about the fighting qualities of the air forces, about leadership or morale.¹⁹ The outcome of the air war was not an entirely foregone conclusion; battles still needed to be fought and won; outcomes were affected by leadership qualities or high morale. It can be shown that combat skills did compensate for strategic misconception or numerical inferiority during the war, and neither side had a monopoly of such skills, nor a monopoly of error. But there was in the end no way of compensating for any failure to use air power in a more general, extensive way, or the failure to supply very great numbers of aircraft and pilots.

2 Air Power and Economy

It is impossible in any discussion of the effectiveness of air power to ignore the importance of supply, and the questions surrounding the mobilisation of economic power for the air war. This is not simply a case of saying that sheer numbers decided the air war, for there remain examples of air combat where that was not the case. But taking the wider view, aircraft production mattered because of the nature of air warfare itself. Air combat was characterised by very high rates of attrition and by the continuous demands of air fighting.²⁰ Winning air superiority

was not a matter, as it might be today, of a quick air conflict between highly specialised and almost irreplaceable air units. It depended on a regular and long-term supply of high numbers of aircraft that were relatively easy to reproduce, and whose supply was limited only by the demands of the other services or the finite limit of industrial resources. Large-scale supply of aircraft (and of pilots) did give an important strategic flexibility, the opportunity to use aircraft in a variety of ways, and to build up extensive reserves. The nature of the weapon and of air fighting gave air power a more overtly economic core. Of course, the possibility of using aircraft in these different operational roles depended on the state of technology, on the quality of aircraft as well as the quantity. In the war that was fought after 1939 aircraft had reached a stage of development that permitted large-scale production of units that would be strategically effective and which matched existing factory practice and technical experience. A war fought five years sooner would have resembled the limited air combat of the First World War; a war fought ten years later would have produced aircraft that were so technically complex and expensive that 'mass-production' air power would have been almost impossible on the same scale. Strategy was tied to economic possibilities and technical innovation much more in air warfare than other areas of the war.

It is therefore of critical importance that air-power history should be able adequately to explain the different conditions that gave rise to a situation in which the Allies produced 151,000 aircraft in 1943 and the Axis powers 43,000, the widest gap of the war. Obviously part of the answer lies in the strategic risk that brought Germany to war with the other three major industrial powers in 1941, against which only very large quantities of weapons, or new weapons altogether, could have tilted the balance, however operationally effective German forces were. Conversely it would be fair to assume that, with odds of this order, the Allies could be permitted qualitative lags or poor tactics and still be able to achieve air superiority. But as is well known, even the technical lead enjoyed by Germany in Europe, or Japan in the Far East (or for that matter Italy in the early 1930s) was lost, too. For this widening gulf between the two sides there are fundamental explanations, besides the question of size alone, which are to be found in the ability to mobilise industry efficiently, to involve and rely on the judgement of engineers and managers rather than soldiers, and to create a

satisfactory balance between military needs and those of production. For the Axis powers the productivist vision of war, which the new industrialised warfare needed, was one which the armed services found impossible to grasp or support effectively. The necessary co-operation between soldiers and civilians was lacking, and the result was poor evaluation, constant military interference, waste of resources, and loss of morale in the economy to a quite extraordinary degree.

The engineers at the Luftwaffe research station at Rechlin reported to SS leaders in August 1944:²¹ 'nobody would seriously believe that so much inadequacy, bungling, confusion, misplaced power, failure to recognise the objective truth and deviation from the reasonable could really exist'.

Those same engineers had a clear view of what needed to be done: The German officer must no longer be allowed to fight against the British and American engineer; instead the German engineer must take up the fight against the enemy's technology'

The answer was to make the very best use of Germany's industrial resources and modernised society. There were two further recommendations: '(1) The immediate replacement of amateurs in key technical posts by our best specialists. (2) A drastic limitation of the types of aircraft and the simultaneous creation of a basis for maximum mass-production.'²²

In a single memorandum the Rechlin engineers had pinpointed the real problem in German economic and technical mobilisation. Germany was by any standards an advanced industrial power; political irresponsibility and a military caste mentality had prevented the effective utilisation of the fruits of modernisation. In all three of the Axis powers there was exhibited a healthy disdain for the commercial view of war. Where the Allies (Russia included) saw it as the function, indeed the duty, of industry to co-operate to the full in taking responsibility for production, even for development and invention, these were responsibilities which industry was not allowed to share fully on the other side. For rather special reasons, this was a problem magnified in aircraft production by the size, technical complexity and expense of individual projects. A bad mistake or misjudgement was catastrophic in aircraft production, where in the production of small arms, or even tanks, it was tolerable. Aircraft production was also the largest economic sector of the war effort, distorting the whole industrial system, making exorbitant demands on the labour force. More than any weapon its

production required a high degree of planning, central control, careful distribution of resources – in short, an effective managerial system. Industrialists and officials working closely together could hope to provide it. Yet it was in just this area that the Axis powers were deficient, with the result that problems at the overall level of management were then transferred throughout the production pyramid, to produce the effect that Willi Messerschmitt described as ‘planlessness’.²³

America was at the other end of the spectrum. It is perhaps not too much of a simplification to argue that American leaders had a managerial, even commercial, view of warfare. Such a view extended to the air leaders themselves. General Arnold, chief of the Army Air Forces in the Second World War, admitted that ‘after World War I the lesson of the failure of aircraft production in 1917–18 remained uppermost in my mind’.²⁴ Throughout the 1920s the Air Corps planned the mobilisation of the air industry and the conversion of related industries in the event of war, and alone of the major powers on the eve of war America possessed a broad-based, integrated economic plan for the expansion of aircraft production, including everything from the building of new floorspace to the stockpiling of rare metals and inventories of essential components and tools in general manufacturing. The Air Corps judged that its ‘strength should be superior to any possible enemy air force and is limited only by the number of pilots who can be procured and the number of planes available’.²⁵

Roosevelt’s first step in preparing for war in 1938/9 was to sanction the economic base necessary to support future warfare.²⁶ The great production achievements of 1941–5 were rooted in the realisation that mass-production, efficient labour use and industrial mobilisation in general could best be managed by those who knew about management and production. The economic dimension to air power mattered in America’s air effort because it was meant to matter. Production was regarded as the foundation of war conduct; and estimates of enemies were based not so much on political intention or fighting capability, but on answering the question: what could they produce? The productivist view of warfare no doubt had drawbacks, though it is hard to think of any that were critical; but it had the other great advantage that far from producing the cheap, obsolescent aircraft that German critics thought mass-production would bring, the co-operative involvement of engineers and scientists actually contributed to supplying the American air

forces with high-quality weapons as well. Though the Army Air Forces did issue specifications based on combat need, it was also possible for industry or science to push the technical threshold forward themselves.

It could well be argued that in this critical area of production the United States, and Britain, too, benefited from the greater degree of social integration of their élite groups and the more significant part that commercial success and bourgeois values played in public and political life. By contrast Germany and Japan had fragmented élites, conservative value-systems, and a dominant militarism, all of them legacies that the recent growth of bourgeois culture and modern industry had not yet completely transcended. That is not to say that economic modernisation did not exist, for it demonstrably did, but that its fruits were appropriated by institutions and social groups incapable of using them to the full, or inhibited from doing so by the nature of the political structures that the crises of modernisation in the inter-war years had produced.

But this was not the whole answer. The economic dimension of the air war cannot ignore the fact that for much of the conflict all three Axis powers were subject to strategic bombing attack. Though there will continue to be argument about the relative merits of the target systems chosen, or the material cost of the campaigns, there can be little doubt that the productive performance and strategic options of the Axis states were circumscribed by the impact of bombing. While war production continued to expand, the underlying basis for production in the future was slowly but surely eroded by bombing, while bomb attack produced cumulative disruption to the sensitive production and distribution web established to cope with the deficiencies of air production demonstrated in the early part of the war. Bombing inhibited further rationalisations, and produced a situation in which managers and workforce alike were compelled to work within certain organisational and even moral limits that the opposing economies never faced.²⁷

This is a difference that is still too little emphasised in studies on air warfare. It is simply implausible to suggest that productive performance was not adversely affected by such a scale of regular and destructive bomb attack. Italy's economy experienced devastating, if unpublicised, attack for most of the war, which prevented any real expansion of war production there at all.²⁸ Japan's fragile war economy was all but destroyed in the final months of war. Though German production expanded

through 1943 and 1944, the expansion was still well below what the economy, uninterrupted by attack, could have produced and was planning to produce; and sustained air attack brought political crisis and the concentration of economic control in the hands of the increasingly wayward SS. An effective German air defence, or the absence of a bombing offensive, would have substantially altered Germany's strategic position between 1942 and 1945, and might well have allowed the uninterrupted and balanced expansion of her air forces to a point where the attrition cycle could have been transcended, and the high operational and fighting skills of the German air forces have been brought to bear more damagingly. In this sense the economic conception of warfare in the West, that production mattered, including the destruction of the enemy's production, was vindicated. It is worth reflecting on what effect a sustained bombing offensive might have had on Britain and the United States: not only on production, but on their willingness to sustain the war.

3 *Air Power and Society*

The question of the efficacy of bombing returns to the issue of what impact air power had on society as a whole, to the view that air power turned the Second World War into total war. This is certainly a view that can be overstated. But there is a real sense in which the air war did involve, involuntarily or otherwise, ever larger sections of the civilian population. As one senior RAF officer told an audience in 1936: 'War now of national character . . . No longer possible to draw a definite line between combatant and noncombatant.'²⁹ This situation was a consequence of the demands made by the procurement and production of aircraft and the servicing and training of the air force; and of the depth of organisation required to cope with these demands at every point of the production or servicing programmes; and, of course, of bombing.

But there was another dimension to air warfare: the organisation of civilian defence and anti-aircraft forces, and with it the popular, public, recognition that air power in the shape of the bomber affected populations in a different way from warfare in the past. Soldiers could not be sure that under the impact of destruction and death civilian populations would demonstrate the same fortitude and resilience as men under fire, and much of the evidence from the First World War suggested the opposite.³⁰ It was on these grounds that the RAF became con-

vinced that moral collapse was the most likely outcome of bomb attack, and that it would set in quickly and with clear political results if pursued ruthlessly enough.³¹ This raised all kinds of legal and ethical issues, which led to political constraints at the outbreak of war on both the RAF and the Air Corps to prevent them attacking civilians indiscriminately. Air leaders in both countries saw this as only a temporary restriction, likely to be lifted when the enemy attacked their own civilians, or when the situation became desperate.

Belief in the effect of bombing on morale and fear of civil collapse placed a great premium on preparing populations in advance for bomb attack. The digging of air-raid shelters, the distribution of gas masks and air-defence literature, the establishment of a vast army of observers, air-raid wardens, and fire-fighters, was an organisational task of great magnitude, and it had the effect of turning a great number of civilians, men and women, into a home-front army. The blackout was a form of social discipline that served the dual purpose of obstructing enemy attack but also of maintaining a day-to-day commitment to the war effort, a regular, almost ritual, reminder of the nature of the war they were fighting. In one of his evening monologues in 1942, Hitler expanded on the participation of civilians in the air war: 'If this war continues for ten years . . . in Germany every man and every woman will belong to an anti-aircraft crew. With an annual production of six thousand anti-aircraft guns, every little village in Germany will soon have its own battery and its own searchlight section, and the whole Reich will be one single, integrated defence unit.'³² This was the logic of a war between peoples.

The social history of air warfare has still to be written in full; but existing studies show that the impact of air attack could be used by governments to maintain allegiance and share out the sacrifices – even to increase the willingness for war among those sections of the population less directly affected. In Germany squads of SA men helped to clear up the bomb damage, compensating the party for the loss of confidence in the political leadership brought about by the bombing in the first place. It is a testimony to the effectiveness of preparations for air attack, practical and psychological, and the social discipline that they engendered, that morale did not collapse in the sense that the bombing strategists expected.³³ The same point could be made about those who volunteered for air fighting, often in the full knowledge that the chances of survival were negligible and in

the face of overwhelming odds. The nature of moral and social commitment, of group loyalty and combat preparation calls for a history of its own. Air power produced its own distinctive brand of courage and participation, and produced closer bonds between population and military than did the First World War. The most enduring popular images of the war remain the images of air warfare, from the bombing of Warsaw and the Blitz on Britain, to Dresden and Hiroshima, and they remain so because this was a war between pilots and people.

Air power did indeed, as the prophets had said, bring war to whole nations. This is not to argue that air power was decisive, as the prophets had also claimed – capable of winning the war on its own. But air power did contribute to deepening and broadening the war effort, through the management of the resources that it needed, through the organisational and intellectual skills that it required, through the moral effects and social consequences of air defence and air attack. The air war of 1939 to 1945 was unique in its nature and scope, calling on a degree of economic and technical modernity, social cohesion and discipline, moral reserves and organisational skill unequalled by previous conflicts. States with weaker economies, less organisational experience and more fragmented societies could not cope with these demands. Even for the states that remained in the air-power race during the war, the peculiar demands of air fighting often met with partial or imperfect response to the circumstances of war. The states that endured were those which recognised what modern total war meant, and mobilised their national resources effectively enough to meet that need. In this sense success or failure in the air was a test not just of fighting skills, important though they were, but of national mobilisation in general.

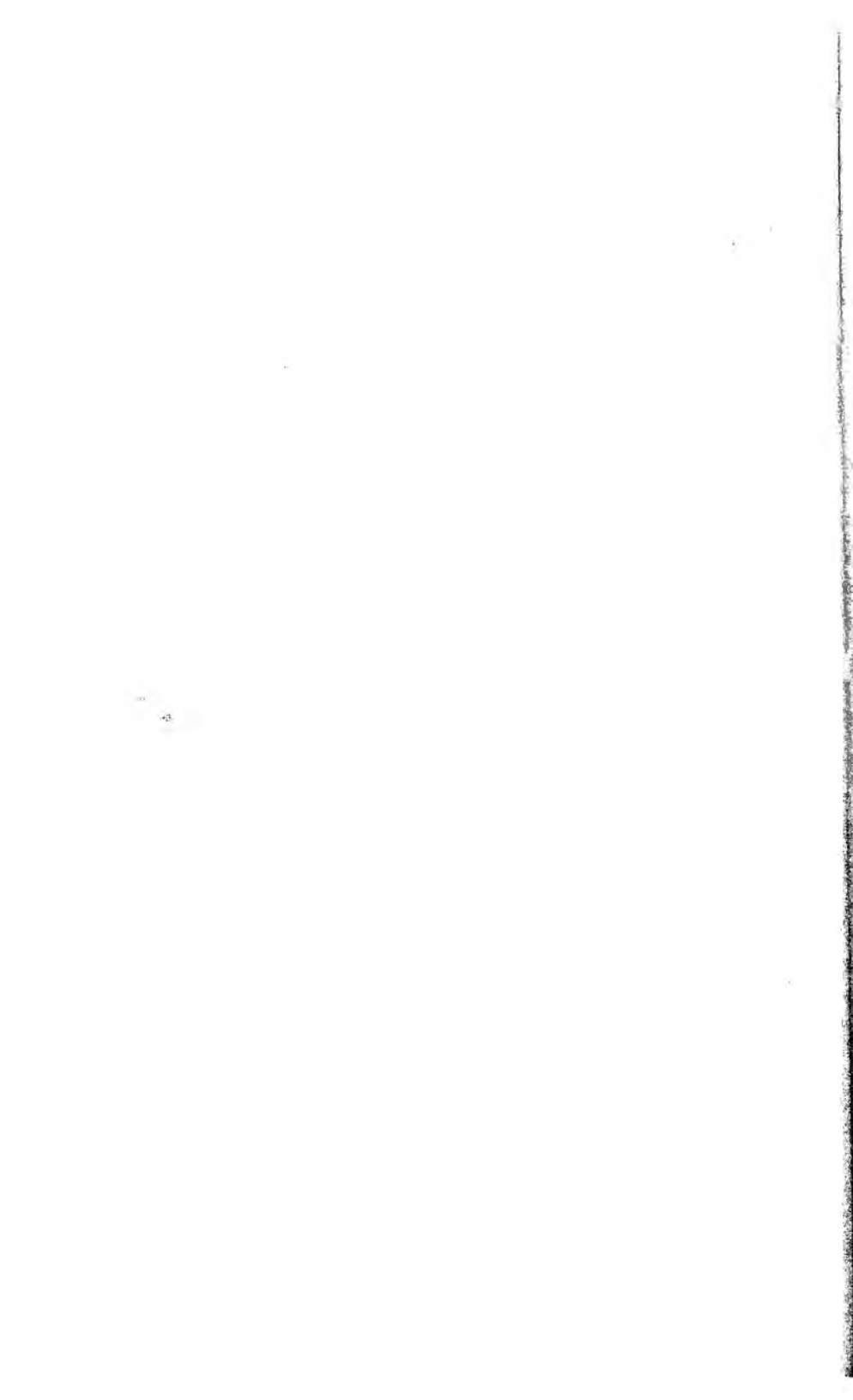
Notes

1. Library of Congress, Andrews Papers, Box 11, Lecture at the Air Corps Tactical School by Major Harold George, 'An Inquiry into the Subject War', 1936, p. 3. George added: 'also we realise that neither land power nor sea power has proved itself in the face of modern air power'.
2. W. Mitchell, *Winged Defense*, New York, 1925, p. 214.

- 3 National Archives, Record Group (hereafter cited as NA, RG) 18/229, Draft of a speech by General M. Patrick, n.d. (c. 1923), p. 13.
- 4 Office of Air Force History (hereafter cited as OAFH), Washington DC, Lecture on Bombardment Aviation by H. L. George at Marine Corps School, n.d. (1935?), p. 4.
- 5 Cited in R. H. Fredette, *The First Battle of Britain 1917-1918 and the Birth of the Royal Air Force*, London, 1966, p. 225.
- 6 Weir Collection, Churchill College, Cambridge, WEIR 1/2, Memorandum by Sir Henry Norman for Secretary of State for Air, 25 March 1918, p. 2.
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- 8 NA, RG 165/888 97, Memorandum for War Plans Division by Col. Krueger, 'Air Defense as a Factor in National Defense', Dec. 1935.
- 9 P. Bernard, 'A propos de la stratégie aérienne pendant la Première Guerre Mondiale: mythes et réalités', *Revue d'histoire moderne et contemporaine*, 16, 1969; P. le Goyet, 'Evolution de la doctrine d'emploi de l'aviation française entre 1919 et 1939', *Revue d'histoire de la Deuxième Guerre Mondiale*, 19, 1969; K. Whiting, 'Soviet Airpower and Aviation under Stalin', in R. Higham and J. W. Kipp (eds), *Soviet Aviation and Air Power: a Historical View*, London, 1978.
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- 11 Because most air fighting took place over the front line, and the line itself was so long, there was a tendency to measure aircraft needs by the size of the army rather than by the strategy to be pursued. There is interesting discussion of these problems in Edgar Gorrell, *The Measure of America's World War Aeronautical Effort*, Northfield, Vermont, 1940 (Norwich University Publication No. 6). Gorrell was one of the American airmen sent to Europe in 1917 to work out how many aircraft the expeditionary force would need.
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- 18 NA, RG 18/223 Box 1, RAF War Manual, Part I, Operations, May 1935, p. 57.

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20. These views are forcefully put by W. Murray, *Strategy for Defeat, The Luftwaffe 1933-1945*, Washington, DC, 1983.
21. OAFH Library, 'A Memorandum to the SS and RSHA Berlin, from Engineers at the Rechlin Aircraft Experimental Station, 15 August 1944', p. 1.
22. *Ibid.*, p. 6.
23. Speer Collection, Imperial War Museum, FD 4355/45 no. 43, letter from Messerschmitt to Tschersich, RLM, 13 March 1940, p. 2.
24. H. H. Arnold, *Global Mission*, New York, 1949, p. 62.
25. NA, RG 18/223 Box 4, Memorandum for the Chief of Staff, 4 April 1932, 'Wartime Allocation of Airplanes to the Army', p. 2. Current plans were to produce approximately 20,000 aircraft in the first year of a war.
26. NA, RG 94/580, Air Defense Board, for the President, Dec. 1938, 'Summary of the important questions to be studied in connection with the expansion of aircraft production'.
27. Overy, *Air War*, pp. 123-5.
28. S. Harvey, 'The Italian War Effort and the Strategic Bombing of Italy', *History*, 70, 1985, pp. 32-45. It was estimated that Italian production was cut by 60 per cent as a result of bombing.
29. Public Record Office, London, AIR 9/39, lecture by Air Vice-Marshal Barratt, 'Air Policy and Strategy', p. 1, 23 Mar. 1936.
30. See for example PRO AIR 9/8, Address by the Chief of Air Staff, 3 April 1923, pp. 1-3; AIR 9/8, comments on COS 156, 26 May 1928, by Sq. L. Bottomley: 'There is ample evidence to prove that the industrial population is most susceptible to panic and loss of morale . . . German air attacks on England greatly affected public opinion.'
31. NA, RG 18/223, RAF War Manual, p. 59: 'Although the bombardment of suitable objectives should result in considerable material damage and loss, the most important and far-reaching effect of air bombardment is its moral effect.'
32. *Hitler's Table Talk 1941-1944*, ed. Sir Hugh Trevor-Roper, 2nd edn, London, 1973, p. 669, entry for 28 August 1942.
33. E. Beck, *Under the Bombs: the German Home Front 1942-1945*, Lexington, Ken., 1986; G. Kirwin, 'Allied Bombing and Nazi Domestic Propaganda', *European History Quarterly*, 15, 1985, pp. 341-62.

PART II
The Air Forces and the
Armaments Industry



2

The German Aircraft Industry in the First and Second World Wars: A Comparison

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A comparative assessment of the German aircraft industry in the First and Second World Wars requires a study of the industry within the context of wartime industrial mobilisation, as its performance was critically affected by a variety of factors external to it. While an exhaustive treatment of this subject would require a substantial book, this paper will attempt the following comparisons. An examination of the leadership of the German air arm in both world wars and its effect on the aircraft industry precedes a discussion of a critical yet often ignored factor of aircraft production, the effect of the development and manufacture of aero-engines on the aircraft industry's evolution in 1914-18 and 1939-45. Then an overview of the German aircraft industry in the eras 1908-18 and 1933-45 takes into account pre-war and wartime developments, concentrates on the growth of the industry and its handling of labour and material shortages, and compares German aircraft and production figures to those of Germany's opponents. The paper concludes with a comparison of how well the industry in both wars met perhaps the most crucial technological test of all - the ability to evolve new aircraft in wartime.

The leadership of the air arm and aircraft procurement in the First World War functioned in a simpler universe than the Byzantine world of the Nazis in the Second World War. In the purely military world at the top in the First World War there was unusual continuity and harmony among the ranking air-force officers, who had pre-war service in aviation and, once appointed, remained at their positions for the war's duration. The two most significant soldiers in the military-industrial relationship

in First World War aviation were Colonel Hermann von der Lieth-Thomsen and Lieutenant-Colonel Wilhelm Siegert. As a captain Thomsen had been the first chief of the German General Staff's Technical Section, which was formed in 1908 to observe aviation development. The Technical Section was placed within Captain Erich Ludendorff's Mobilisation Department, and both Thomsen and Ludendorff became ardent advocates of the aeroplane. When a Chief of Field Aviation was created on 26 April 1915 to direct all aviation affairs, because the need was evident for one overarching authority to command staff officers at army headquarters and 'to organize a systematic mobilization of the aviation industry',¹ Thomsen became that authority. Chief of Field Aviation, and then Chief of Staff when a Commanding General of the Air Force, Lieutenant-General Wilhelm von Hoepfner, was appointed in October 1916, Thomsen was the principal architect of German aviation, and deserves much of the credit for the mobilisation of German aviation during the war.

Colonel Max Bauer, Ludendorff's *éminence grise*, praised Thomsen as a tireless, energetic and capable officer with an extraordinary understanding of technology. He lauded Thomsen's 'great service in the development and production of aeroplanes and the training and use of the flying troops'. Bauer observed:

We argued constantly about questions of raw material and labour; and his aggressive manner made him feared in all quarters. But what he did and said was essentially clear and justified, and I would only have wished that there were such men everywhere. I have always openly admired him, particularly from a human standpoint. He stood up for his subordinates on principle and at all times; in short, he was an unafraid, courageous, and intelligent man with a warm heart for the army and particularly for his fine troops.²

Siegert, one of the most imaginative and dynamic of the air arm's officers before the war, became aviation adviser to the High Command on 19 October 1914. In this role he was instrumental in the formation of the first bomber units in 1914 and of the office of Chief of Field Aviation. He became Thomsen's deputy in April 1915, and Inspector of Aviation in October 1916 with the appointment of Hoepfner. As deputy and then inspector he was responsible for the mobilisation of the aircraft industry for most of the war. If Siegert occasionally wielded his power

inappropriately in an attempt to militarise the industry, this abrasive and imaginative officer bore on his shoulders the taxing and immense burden of military-industrial relations: as intermediary between the staff at the front and the industry in the rear, he was hard pressed to satisfy either.

Yet under Siegert's guidance, the inspectorate essentially rationalised the German aircraft industry, beginning the process in 1915 with the imposition of more efficient accounting and management procedures on some factories and the promotion of aircraft production at large companies. The inspectorate's measures of 1917 and 1918 – the introduction of industrial norms and of equipment and procedures for mass and licensed production, the amalgamation of companies, and the closing of small, inefficient, and out-of-the-way plants – constituted a determined effort to rationalise the industry under wartime pressure.³

After the accession to high command of Hindenburg and Ludendorff, the aeroplane was assured of Ludendorff's staunch support as a top priority of the German war machine for the rest of the war. At Thomsen's request, Ludendorff opted to keep aircraft procurement separate from the Weapons and Munitions Procurement Office (*Waffen-und-Munitions-Beschaffungs-Amt*, or Wumba), which was supposed to control all procurement and eliminate fragmentation and conflicts among procurement agencies. This special position complicated overall procurement and impaired Wumba's effectiveness, but it assured total subordination of aircraft procurement to Hoepfner and Thomsen, and enabled Siegert to function independently of Wumba. This status would facilitate the efforts of the Commanding General and the Inspectorate to mobilise the German aviation industry.⁴

At each mobilisation programme – the Hindenburg in October 1916, the America in June of 1917, and the continuation of the America programme in June 1918 – Ludendorff unfailingly supported a doubling of aircraft production and was prepared to exempt aircraft manufacture from any reductions in the arms industry in April 1918. In the America programme, the air arm and Ludendorff reckoned with greatly increased aerial opposition over the western front in 1918 from America's entry into the war, and they consequently placed aviation high on the priority lists for raw materials and manpower and set high goals for the industry to attain. If they misjudged the impact of American intervention on the air war, they were at least cognisant of its potential effect on the Entente's war effort and

prepared to respond as rationally as possible to the likelihood that American entry into the war would further imbalance the air war against them.

Condemnations of the Hindenburg programme's attempt to mobilise and militarise the German economy have ranged from the remark of Deputy Chancellor and Secretary of the Interior Karl Helfferich, who opposed the high command's intent to militarise the German economy, that 'An army suffers itself to be ordered about, but an economy does not',⁵ to historian Gerald Feldman's assessment of the programme as 'a gamble in which the nation's financial resources were recklessly exposed to exhaustion on the basis of unfounded expectations', a venture which 'had very little to do with either sound military planning or rational economics'.⁶ Yet the German Army's mobilisation of the aviation industry appears an exemplary exercise in rationality compared to the experience of the Second World War.

Hitler was not an able planner, and paid no attention to the strength of his opponents. The position of aviation in the priority lists fluctuated, actually declining in the critical first part of the war in crucial categories such as labour, materials and railway allocations. Furthermore, as historian Richard J. Overy observed, there was an 'extraordinary' gap of communications between Hitler and his air force. The Luftwaffe's relative isolation under Goering led to an increasing disparity between Hitler's demands and actual air strength in the early years of the war, exemplified by Hitler's demand for a fivefold increase in the Air Force in 1938 and Goering's decision to ignore the order in the existing economic circumstances.⁷ The leadership of the Luftwaffe before and during the Second World War left much to be desired. It appears to have reached a peak at its origins in 1934-6, some four years before the conflict. Neither Hitler nor his henchman Goering was suited to direct an air war and an air force; they were not professionals, they denigrated professionals.

While nothing could have changed their attitude or the Byzantine nature of the Nazi high command, for the first two years of the regime, until 1936, the Luftwaffe developed rapidly, primarily because it was in the hands of an exceedingly capable Chief of Air Staff, General Walther Wever.

Historian Edward Homze suggested that the triumvirate of Goering, Wever and Milch worked effectively together.⁸ Goering in 1933 and 1934 was an energetic, confident and aggressive leader, whose reckless impulses needed channelling along con-

structive lines. Wever was perfect for this role. As a colonel he was regarded with von Manstein as one of the most outstanding young officers in the Reichswehr, a skilled planner and organiser who understood modern air technology and became a keen and balanced air strategist. Milch was perfect for the production end, less able with regard to technology or air strategy, but suited to co-ordinate an industry with strong-willed prima donnas like Messerschmitt or Heinkel. The chief of the technical office in the air ministry (RLM, or Reichsluftfahrtministerium), Colonel (later General) Wilhelm Wimmer, and his chief assistant Colonel Fritz Loeb were also very capable officers, who, like Wever, had been steered to the Luftwaffe from the Reichswehr by the chief of the personnel office, Hans-Juergen Stumpff. With Wever's air staff setting the specifications for advanced aircraft and Wimmer's office handling the technical details, by 1936 the Luftwaffe was ahead of its competition, flying prototypes of the Messerschmitt fighters Me 109 and Me 110, the dive bomber Junkers Ju 87, and the medium bombers Dornier Do 17 and Heinkel He 111, as well as the four-engined bomber prototypes the Junkers Ju 89 and Dornier Do 19, while the British were just issuing specifications for four-engined bombers.⁹

A man of Wever's acknowledged talent was invaluable. In fact, as the 'linchpin' in the Luftwaffe leadership team, he was perhaps irreplaceable. Three months before he would have become the first Chief of the Luftwaffe General Staff, he was killed in a flying accident on 3 June 1936, and from then on the administrative picture became increasingly one of disarray, intrigue and poor appointments, the most disastrous of which was undoubtedly Hitler's appointment of Ernst Udet to replace Wimmer as head of the Technical Office. In a job that required hard work, concentration, and competence in aviation production, Udet lacked all the necessary qualities, and then lost his production chief Loeb to an office in the four-year plan. Without the ballast of a Wever, the intrigues among Goering, Milch and Udet prevented coherent planning, and Goering compounded the problem by establishing on 1 February 1939 a formidable new bureaucratic structure, the office of Air Armament (Generalluftzeugmeister) with Udet at its head.¹⁰

One must be careful neither to exaggerate nor diminish the importance of the individual, but it is clear that Wever, Wimmer and Loeb were capable, and that Udet was incompetent. The combination of the demise of Wever with the rise of Udet spelled disaster for the Luftwaffe, for the German aircraft

industry was going to be bereft of the leadership that an armament industry requires from the government for the effective production of quality aircraft. One cannot state with certainty how well Wever would have managed matters, but certainly his capabilities as a strategist and planner, his eminence within the air force and the air ministry, and his ability to coexist with Milch and Goering were lost, and after his death what was lacking was a strong professional officer in the top echelon.

This paper will not discuss in depth the erratic nature of planning, and the failures and constant changing of production plans under Goering and Udet after 1936, which reached a nadir in the period 1938-41, until Udet's suicide. Historians Edward Homze, Richard J. Overy and Williamson Murray have argued convincingly that this disaster, a failure of the Nazi command, lost the war in the air for Germany in 1940-1, as the Luftwaffe failed to respond to the increasing war of attrition in the air while the allies were mobilising tot ally.¹¹ Given the Luftwaffe's leadership, or rather the lack of it, after 1936, it is not surprising that this was the case.

Long before the more recent spate of works on the Luftwaffe, Burton Klein's book *Germany's Economic Preparations for War* (1959) documented serious problems in aviation procurement.¹² Frequent changes in the basic decision of whether to build a fighter or bomber force and in designs and models of aircraft prevented the use of mass-production techniques and led to incoherent orders to industry. The following comic-opera case of the Henschel firm, which Klein acknowledged was perhaps an extreme one, is none the less instructive, as I know of no comparable example from the First World War. Henschel was building Ju 88 bombers in 1940 when the RLM ordered it to build its own craft, the ground-attack plane Hs 129. Production tooling was half-completed when the contract was cancelled and Henschel was ordered to build the Ju 88's successor, the Ju 188. Just as the Ju 188 was about to enter production, the RLM substituted the Me 410 fighter-bomber. When the company was 80 per cent tooled up for production, it was then ordered to produce the Ju 388, successor to the Ju 88 and 188; and just as it prepared to begin production of the Junkers bomber, the RLM decided to cease bomber production. The Henschel plant manufactured wings for the Ju 88 night fighter for the rest of the war. German statisticians estimated that in 1942 frequent design changes that prevented the industry from pushing serial pro-

duction to the hilt caused a 20 per cent loss in total aircraft production.

Klein noted other examples of failures of leadership that had dire consequences for production, in particular the frequently cited discussion between Goering, Chief of Air Staff Jeschonnek, and Milch of the RLM in March 1942, in which Goering and Jeschonnek sought the absurdly inadequate production of only 360 fighters monthly, Jeschonnek commenting 'I do not know what I should do with more than 360 fighters.' The running eighteen-month discussion between Hitler and Goering on the one hand, and Milch on the other, about whether to concentrate on bomber or fighter production led to the issuance and then cancellation of production orders. A final ludicrous example of Nazi procurement policies was Goering's 'court-martial' procurement system, where if plant managers carried out government commands to deliver in a specified period of time, they were decorated in an impressive ceremony. If they failed, they were court-martialled, only to be acquitted when they blamed their failure on the failure to receive promised labour, tools, materials and components.

If the essence of the military's role in the procurement relationship is to set its needs clearly before the industry and then to monitor and control judiciously the industry's efforts to meet these needs, the RLM failed miserably on the first count. On the second, it wavered between the inappropriate extremes of either allowing the industry to set its own production goals or court-martialling managers who failed to deliver. With Udet's death, and Milch's and later Speer's control of aviation production, which brought aviation under the unified control of a ministry of armaments in 1944, aircraft production rose dramatically; but these measures came too late to affect the outcome of the war. It is hard to escape the conclusion that the leaders of the air arm, and thus the directors of industrial mobilisation in aviation in the First World War, were superior to their counterparts of the Second World War in professionalism, planning ability, and rational approach to warfare and to industrial mobilisation, and that they operated in a bureaucratic environment that, despite criticisms of the mobilisation of the economy in the First World War, was more efficient, stable and centralised, and less capricious than that of the Nazis before and during the Second World War.

Aero-engine production is perhaps the most crucial factor in aviation, yet the most ignored by aviation historians. Much

work remains to be done on aircraft engines in general and the German piston-engine industry in particular, because in both world wars it was a limiting factor in aircraft performance and production, leaving Germany at a distinct disadvantage compared to her enemies.

Before the First World War Daimler monopolised German aircraft engine production with its 100-horsepower six-cylinder liquid-cooled inline, and the German engine companies preferred to concentrate on automobile engines rather than aero-engines. Only in 1914 was the Daimler, perhaps the most durable and reliable engine of the time, supplemented by the Prussian War Ministry's inclusion of the Benz factory in its aero-engine orders. During the war Daimler essentially maintained its near-monopoly of aircraft-engine production, although other firms such as Benz and Opel also manufactured aviation engines. In 1918 BMW developed the superlative high-compression 185-horsepower engine that powered the Fokker D7 pursuit plane to great success in the last few months of the war. Daimler's position made it immune to military pressures to promote licensed production, and in 1918 the company could still refuse to open its ledgers to army inspection despite the threat of militarisation.¹³

The Daimler monopoly combined with other factors to confine German aeroplanes to dependence upon six-cylinder inlines and to limit their production and performance for the duration of the war. Six-cylinder inlines were sturdy, fuel-efficient and reliable – essential considerations for a country suffering from increasing wartime raw material, fuel and manpower shortages. On the other hand, they possessed neither the lightness of early Allied rotaries nor the high horsepower of later Allied V engines. Germany's limited production capacity also prompted two critical mistakes by the aviation inspectorate, which lacked engine experts and focused on aeroplanes, rather than engines, until 1917. On 16 November 1914 it decided against the development of engines of more than 150 horsepower in order to avoid disturbing production, just at the time when French and British aero-engine experts were determining that higher horsepower engines would be essential for the prosecution of the war. The inspectorate's decision delayed the development of higher horsepower engines at a critical time, as it took at least nine to twelve months to develop an engine in those early years. Then in 1915 the inspectorate declined a Benz V engine of 240 horsepower, only to order 500–600-horsepower

engines(!) for R-planes in a later fit of fantasy, thereby deflecting German engine development for another year.¹⁴ For the duration of the war Germany was forced to rely primarily on improvement in aircraft technology for improved aircraft performance, while the Entente could rely on higher horsepower, as Hispano-Suiza, Renault, Rolls Royce, Liberty and Bugatti were delivering 300–450 horsepower engines by the end of the war, compared to the 185–250-horsepower range of German aircraft engines. Finally, while German total wartime production of 41,000 engines surpassed British efforts by 1,000 engines, it was overwhelmed by French production of 88,000 engines.¹⁵

In the Second World War from 1939 to 1944 Britain outproduced Germany in aero-engines by 241,956 to 184,075, establishing a production lead at the war's beginning that the Germans were never able to overtake. The United States produced 802,161 aircraft engines from 1940 to 1945.¹⁶

Historian Edward Homze noted the low level of production and poor performance of German aircraft engines in the early and middle 1930s, and observed that in 1933 the German aircraft engine industry relied largely on foreign designs and was not on a par with its major foreign counterparts.¹⁷ Engine historian Herschel Smith refers to a 'grey area' in the history of Nazi efforts to redirect their aircraft-engine development in the mid-1930s through the subsidisation of the Daimler-Benz and Auto-Union companies in international automobile racing. While some have speculated that the real reason for the subsidies was the underwriting of aircraft engine development, Smith believed that the Nazis hoped for technical and propaganda benefits from the racing programme, received neither, and probably could have better employed their resources directly in aero-engine development.¹⁸

Experience in the First World War among all the powers – Daimler and Benz in Germany, Rolls Royce in Britain, Fiat in Italy, the American automobile industry's development of the Liberty engine, and the essential fact that French aero-engine superiority was based on the inclusion of the automobile industry in aero-engine development and production – amply indicated the natural affinity between automobile and aero-engine production. But it also showed that automobile producers turned to aircraft engine production only with government encouragement and incentives of contracts that would make the market sufficiently lucrative to lure them from automobile

production. The development of automobile engines, however successful, could not substitute for the practice of aircraft engine development.

The Germans thus lagged behind other aviation powers in the 1930s, as their first cast-block engines, the inverted V 12 Mercedes Daimler-Benz and the Junkers Jumo, appeared in 1936, later than those of other major aeronautical nations. Descriptions of them as being of simple, sturdy construction, with a large displacement in relation to their horsepower¹⁹ remind one of descriptions of German First World War six-cylinder engines in comparison to Entente engines. In the late 1930s before the war, the German aircraft-engine industry was far more concentrated than the airframe industry, as Junkers and Daimler-Benz employed 39.2 per cent of the total labour force in September 1935 and 48.1 per cent in 1938. The plants of the three major engine manufacturers, Junkers, Daimler-Benz and BMW, were also less capable of mass production than aircraft firms, because of their reliance on machining operations and highly skilled workers.²⁰ Richard J. Overy observed that Germany failed to mobilise her motor industry until well into the War, only managing to push it to half its peak capacity for all arms production. In the fall of 1943, Albert Speer's advisers in the armaments ministry would cite the bottleneck in engine crankshaft supplies as a limit to placing a higher priority on fighter production at that time.²¹

In the late 1930s the absence of higher-horsepower engines led to flawed decisions. The notion of coupling two twelve-cylinder DB601 engines mounted side by side in the Heinkel He 177 heavy bomber essentially stemmed from the desire to avoid the uncertainty and delay in developing an entirely new engine of equal horsepower, in other words, from the absence of high horsepower engines and the lack of any prospect of developing any in the near future. The prototypes of what was supposed to be Germany's second-generation strategic bomber showed a tendency to catch fire in mid-air from engine overheating, which earned the craft the nickname *Luftwaffenfeuerzeug*, or 'the Luftwaffe cigarette-lighter'. The problems were not ironed out until 1943, too late for the bomber to see effective service, and it remains a dismal chapter in the history of the German aviation industry in the Second World War: one that stemmed in part from the state of German aero-engines.²²

The Inspectorate of the First World War and the Technical Office of the RLM in the Second World War established a

chequered record with regard to aviation engines, as a final anecdote from the Second War indicates. The Focke-Wulf FW 190, Germany's second-generation fighter, which appeared in 1941, was a magnificent aircraft which used Germany's only radial engine, the BMW 801. Yet the consensus in the Technical Office was that fighters required the small frontal area and consequent low drag of the liquid-cooled engine. Focke-Wulf designer Kurt Tank, in diverging from this opinion with a fighter design that beautifully cowed the radial, had to convince them of the wisdom of his course. Air-cooled radials were less susceptible to battle damage than liquid-cooled engines; the demand for aircraft using liquid-cooled engines would be critical in the coming years, given the number of craft already using them; and the BMW radial in test was already producing more horsepower than would be available from its liquid-cooled counterparts for another two years.²³ Tank obviously was successful; but the very predilection of the Technical Office is reminiscent of the clinging to a single type evident in the First World War. Thus in both world wars, in a country noted for its development of the piston and diesel engines, aircraft piston-engine development and production proved a limiting factor in aviation production.

The German aircraft industry developed within the contexts of its military leadership and its aircraft-engine industry, and as it matured, first in the period 1908-14 and then in the years 1933-45, it confronted further delimiting factors, in particular wartime shortages of labour and raw materials.

With regard to the aircraft industry's relationship to the state, the army's monopoly of the consumer market for aircraft before 1914 enabled it to establish a firm control of the embryonic industry, which it maintained by preventing the formation of cartels or monopolies. It guided the industry in technological matters by setting stringent construction guidelines and standard types of aircraft for the firms, most of which belonged to the manufacturer's trade association, the Convention of German Aircraft Industrialists. The army's contracts sheltered the industry, which had begun in 1908, from the recession of 1911-14, although manufacturers complained constantly of the inadequacy of military contracts. By 1914 the productive capacity of the army's best eleven manufacturers, who employed some 2,500 workers, was higher than peacetime requirements, and early in 1914 the army estimated that its best eight firms could build some 103-112 aircraft monthly, or one-fourth of the total

orders in 1913. The Albatros company, one of the earliest workshops, had established itself as the inspectorate's favoured firm. Most of the major wartime companies and designers, such men as Edmund Rumpler, Anthony Fokker, and Robert Thelen of Albatros, were already established by 1914, and aircraft production was characterised by reliance on skilled craftsmen, primarily woodworkers. Thus, on the eve of the war, the industry's foundations were laid, and it possessed a surplus capacity for wartime expansion, although few foresaw the critical role that aeroplanes would play between 1914 and 1918.²⁴

In the case of the Nazi regime, according to historian Edward Homze, the aircraft industry was controlled, directed and financed by the government to a degree unparalleled by any other major industry.²⁵ It essentially rose with the Nazi government, which had a broader impact on its management than that of older established industries. In the pre-war era the industry's special position under Goering gave it certain advantages, and its position in the German economy of the later 1930s was more favourable than that of the pre-1914 industry, in part because of this political circumstance, but primarily because of the recognised military importance of the aeroplane in the 1930s compared to a general uncertainty about its potential as a weapon before 1914.

Aircraft production in the 1930s in Germany remained essentially based on skilled craftsmen, though now primarily on metalworkers. Because of the Versailles Treaty's prohibition of military aviation in Germany, the aircraft industry in 1933 was actually little larger than that of 1914. It stood ninety-seventh among 279 industrial branches in Germany, and it employed between 2,300 and 3,300 workers. Its rapid growth after 1933 indicated its importance. By 1936 it had risen to fourteenth place, nearly doubling its labour force from 68,894 employees in July 1935 to 124,878 in mid-1936. As of October 1938 146,263 workers were employed in the airframe industry and 57,749 in aero-engine production. By 1939 the airframe industry consisted of sixteen principal firms, with a total of twenty-nine separate plants. Like their pre-1914 counterparts, they belonged to a trade association, the Reichsverband der deutschen Flugzeugindustrie, but membership in the Nazi association was compulsory, as it was, in Homze's words, 'a quasi-public institution under the direction of the RLM'.²⁶ Junkers was the RLM's favoured firm, but in a more direct sense than Albatros had been, because Junkers had been nationalised in 1934, becoming

the 'house firm' of the RLM. As of 1939 and through the first three years of the war, the aircraft industry had once again managed to create substantial surplus plant capacity.²⁷

The German aircraft industry in both wars grew dramatically, aided by procurement agencies that essentially pressured the industry to rationalise production along with wartime growth – an essential effort because the industry laboured under severe labour and material restraints compared to its counterparts among the enemy powers.

In the First World War, the German aviation industry employed at its height some 140,000 workers in the summer of 1917 – 40,000 in the aircraft factories, 30,000 in the engine industry, and 70,000 in subcontracting firms. Thus the maximum size of the total aviation industry during the First World War was smaller than that of the German airframe industry on the eve of the Second World War. In fact, the German aviation industry was the smallest of the three major aviation powers – Britain, France and Germany – in the First World War. The French aviation industry employed some 180,000 workers at its height, while the British industry grew from 60,000 workers in August 1916 to 174,000 in November 1917 to 347,000 at the armistice.²⁸

Compared with the British industry, for which available statistics are more extensive, the German aircraft industry was much smaller, dilution (the replacement of male skilled workers with women and youths) was less, and productivity was higher. In Britain dilution rose from 31.7 per cent in August 1916 to 40.1 per cent in November 1917 to 46.1 per cent at the armistice, and in the summer of 1917 the number of workers required to produce one aeroplane per month in Britain was 120. In Germany, available statistics indicate that at no time was there more than 25 per cent dilution despite the severe shortages of skilled labour in Germany, because of industrial resistance to it and the industry's high priority in the assignment of labour from 1915 through to the end of the war. Yet compensating for the smaller size and lesser dilution of the German industry was its higher productivity. In the summer of 1917 22 workers, 14 of them in the aircraft industry and 8 in subcontracting firms – not 120, as in Britain – produced one plane per month. By the end of the war, the British industry was outproducing the German. While the British had produced 13,766 planes in 1917, a few hundred fewer than the Germans, they built 25,000 in 1918 to the armistice, compared with Germany's 17,000–18,000. Germany built a total of 43,000 aircraft to Britain's 48,000. The best overall

production record and probably the highest productivity as well went to the French industry, which produced 52,000 aircraft.²⁹

The First World War German aircraft industry's greater efficiency when compared with its British counterpart contrasts with the experience of the Second World War. In the 1939-45 war the German aircraft industry produced less and was less efficient than its British counterpart. As historian Richard J. Overy points out, the factory size of the German industry was the smallest among all the Powers, as only Junkers had two factories employing more than 10,000 workers in 1944, those two employing 14,000 and 12,000 workers respectively. The Germans used more subcontracting firms than the British, and suffered the inefficiencies of reliance on skilled artisans and small contractors.³⁰ The labour employed on all aviation orders rose to a maximum of 1,850,000 workers in Germany in 1941, compared to 1,678,000 in Britain in 1943;³¹ but for less production, a point to which this paper will return later.

One might expect that given Nazi attitudes towards women, labour dilution in the aircraft industry would not have equalled the 25 per cent of 1914-18. Airframe plants employed some 450,000 workers in 1944, about 23 per cent of whom were women. Yet perhaps the crucial statistic is that some 36 per cent of the labour force was composed of foreign nationals, and the industry used prisoners of war, political prisoners and Jews to bolster its ranks.³² Many in the last groups were unskilled, as the industry accepted dilution late and hurriedly in 1944. While the peak of German aircraft production coincided with the time of peak labour dilution, there were high levels of absenteeism and labour obstruction, and high labour turnover, which is not surprising given the composition of the labour force. Shirking was such a severe problem in the Second World War that a draft of 403,000 workers assigned to the industry between January and June of 1942 yielded a net increase of only 66,000.³³

While labour unrest, absenteeism and strikes occurred towards the end of the First World War, it does not seem that they were as extensive. In comparison with her enemies, Germany made better use of her labour force in the aircraft industry in the first war than in the second, despite problems with labour in both wars. In the first, labour unrest stemmed primarily from objections to working conditions and wages, which while they placed aircraft workers at the top of the armaments industry, were still inadequate to keep pace with inflation. In the 1939-45 conflict, problems certainly must have arisen from the large numbers of

foreign labourers in the industry and from allied bombing, although the industry in both wars still managed to increase its production to the end.

The responses of firms to raw-material shortages and government rationing of scarce materials were similar in both wars – attempts to evade the regulations. The aircraft industry's resistance to rationing in 1917–18, which the inspectorate labelled 'natural' because of the 'lack of trust' and 'compulsion' related to rationing, impeded efficient mobilisation. This resistance had assumed significant proportions by the late autumn of 1917. In November one firm which was urgently demanding 2,000 kilograms of fuselage varnish was caught with eleven months' supply already on hand. Firms' demands for gasoline in particular often exceeded their consumption. One firm requested 15,000 kilograms, and used 10,000; another, 12,000 kilograms, and used 4,000; a third, 8,500, and used 3,000; and another 30,000, for a consumption of 4,000 kilograms. One aircraft factory was discovered hoarding ninety crates of desperately needed Mercedes engine spare parts. Firms used flight fuel for motor vehicles. Such instances suggest that the factories responded to the shortages and the rationing by circumventing the controls and hoarding precious goods, possibly to trade them for other materials in a black market.³⁴

In the Second World War the waste of precious raw materials was widespread throughout the aviation industry before Milch took RLM matters firmly in hand in 1942. Advisers initially told him that available supplies of aluminium and copper limited aircraft production; but the engineers that Milch sent to inspect the metal consumption of the aviation industry found wasteful metalworking practices instead. In one case better machining practices could save 1,500 pounds of aluminium on one aero-engine alone. They also found flagrant abuses, some of them caused by conflicts of orders from different procurement agencies. At Messerschmitt workers were manufacturing tropical huts for naval contracts for Germany's future colonial enterprises from the Luftwaffe's stocks of aluminium. Other Messerschmitt factories were producing aluminium ladders for vineyards and hoarding secret stocks for emergencies, with similar wasteful use of copper.³⁵

In the Second World War aircraft production was affected by two factors that its 1914–18 counterpart had not experienced. The first, the use of aircraft industries in conquered countries, particularly Czechoslovakia and France, was potentially advan-

tageous to Germany, the second, the allied bombing campaign, definitely detrimental. By March 1939 130,000–150,000 workers in aircraft factories in Bohemia and Moravia were producing for Germany, and with the defeat of France the Nazis planned to impress her aviation and aluminium industries into service to supplement domestic production. Yet the Germans were not able to use French industry to the fullest extent because of inadequate supplies of raw materials, machine tools and industrial power. Furthermore, the extensive and constant modifications to German aircraft required such close contact between the RLM and the industry that the Germans preferred to use 80,000–100,000 Frenchmen in German plants. Although by 1943 the entire French aviation industry worked for Germany, monthly deliveries had peaked early in 1942 at 100 planes and some 250 engines. French labour productivity was also lower than German, and in June 1942 it took four times as many work hours to manufacture a Fieseler Storch in the Morane Saulnier works as in Germany. Thus while the exploitation of the aircraft industries of conquered powers offered very real advantages, the Nazis were unable to exploit French industry to the fullest.³⁶

The great threat under which the German aviation industry laboured in the Second World War was Allied bombing attacks on the industry itself. USAAF attacks arrested fighter assembly in July 1943. Then in February 1944 the USAAF launched attacks on twenty-three airframe and three engine factories that were estimated to have resulted in the immediate loss of production of 1,000 planes between 20 February and 1 April. While the Fighter staff, newly formed in March 1944 to restore fighter production, was able to recoup quickly and ultimately to squeeze out 3,000 planes in September 1944 and 2,300–2,700 monthly during the rest of the year, the bombing upset construction of the fine twin-engined night fighter the Heinkel He 219, wrecked the sole plant making glue for the plywood twin-engined fighter Ta 154, Germany's answer to the British Mosquito, and destroyed the tools for the manufacture of the radical twin-engined fighter the Dornier Do 335.³⁷ The dispersal of production under the Fighter Staff into 75 small airframe and 249 aero-engine shops, a decentralisation necessitated by the bombing, certainly impeded German aircraft production. Salt mines, railroad tunnels, mine galleries and caves were obviously not ideal locations for aircraft plants, nor were planned forest locations any better. Aviation authority William Green estimated that between July 1943 and December 1944 Allied

bombing resulted in the loss to the Luftwaffe of some 25 per cent of total production, equivalent to 18,000 aircraft, of which some 78 per cent were fighters. If Germany had had them, however, shortages of crews, fuel, ammunition and bombs would have prevented their efficient use. The dispersal caused the dilution of already scarce managerial and technical talent and critical bottlenecks of tool and jig manufacture, burdened a collapsing transportation system and impeded the co-ordination and inspection of production.

While the German aircraft industry displayed fantastic recuperative powers, and produced aircraft to the very end, at the war's end Germany's pre-war factories had been devastated.³⁸ Those recuperative powers notwithstanding, the German aircraft industry had produced only 117,881 aircraft from 1939 through to 1945, compared to Britain's 131,549. The only wartime years in which Germany outproduced Britain were 1939, the first year of the conflict, and 1944, the last complete year, when it was too late to affect the course of the air war. Furthermore, the Russians produced 158,218 aeroplanes, and the United States 324,750. In 1944 the USA alone produced 96,318 airplanes, only some 20,000 fewer than Germany's total wartime production.³⁹

These statistics on aircraft production show that in both wars Germany's enemies outproduced her by great margins, a gap that was even wider in the Second than in the First World War. In wars of attrition and *matériel*, the Germans were thus highly likely to lose unless they could establish a qualitative ascendancy sufficient to offset their overwhelming numerical inferiority. The best they could hope to achieve was a temporary and spatially limited ascendancy as the war continued. The wartime maintenance of qualitative aerial superiority depended upon the ability of the industry and government technical agencies to develop new aircraft under wartime stress. In the First World War the Germans were unable to maintain qualitative superiority in fighter development from 1915 through to 1918, despite their recognition that they needed to do so. Equipped with the Fokker monoplane, the Germans established a marginal superiority from the summer of 1915 until the spring of 1916. They then lost it until the autumn of 1916, when the Albatros twin-gun biplane re-established it until the spring of 1917. At the peak of their service in January 1917, Albatros D1-2 fighters constituted 67 per cent of German fighters at the front. Their successor, the Albatros D3, arrived in January and vaulted the

German fighter arm to the zenith of its ascendancy over the British in Bloody April of 1917. Then a new generation of Entente fighters – Sopwith Camels, Se5s, Spads, and Bristol Fighters – entered service that spring and summer, wresting superiority back.⁴⁰

In the mass air war of attrition, it was immensely important that the Germans respond quickly, yet the German air arm found itself ill-prepared to meet this challenge. Developmental work had stagnated in the nine months following the introduction of the Albatros biplanes. Complacent in their ascendancy, the Germans had apparently forgotten that the aerial competition was ever evolving. The inspectorate had always shown a marked predilection for Albatros, its largest and most reliable manufacturer, but at this critical moment, Albatros's successor to the D3, the D5, was nothing more than a modified, and little improved, D3. In the First World War the development of a new aircraft type took six to nine months, so it was not until an open fighter competition in January 1918 that the German fighter arm secured the superior plane it sought – the Fokker D7. Powered first by the Mercedes and later by the BMW 185-horsepower engine, the D7 established its superiority from its arrival at the front in May 1918 until the end of the war, exemplifying the maxim, according to the official British history of the air war, that 'technical superiority, not necessarily of great degree, is a dominant factor in air warfare'.⁴¹ Yet for a year, in 1917–18, the German fighter pilots had been consigned to inferior mounts because of the inspectorate's complacent reliance on the Albatros firm.

In other aircraft categories, the Germans showed themselves equal to the challenge. Their best reconnaissance planes, developed over the course of the war from early observation biplanes, were excellent. Rumpler photo-reconnaissance craft of 1917–18 were capable of speeds of 100 miles per hour above 20,000 feet, and thus virtually immune to interception from allied fighters. Halberstadt and Hannoverana two-seat attack fighters, which formed the backbone of battle flights for close air support, were light, strong, and manoeuvrable, causing the French to lament that they had nothing comparable in 1917 and 1918. Junkers all-metal *Moebelwagen*, or 'furniture vans', were prized craft for ground attack. Furthermore, in the First World War, unlike the Second, the Germans successfully developed strategic bombers to attack Britain, the Gotha G- and the Staaken R-planes. The large Gothas (78-foot wing-span, 39-foot length) and particularly

the huge R-planes (138-foot wing span, 73-foot length) represented prodigious feats of technology and industry in those early years. The eighteen Staaken R6s built dropped 27,190 kilograms of bombs on Britain, with no losses due to enemy action; the Gothas, 84,745 kilograms for the loss of sixty craft. The raids failed to force the British from the war, and the Germans, in the light of the drain on other production, ceased their raids after May 1918 and transferred the bombers to the western front.⁴² Yet the point remains, German aircraft technology proved itself equal to or better than that of the Entente in the First World War, but not sufficiently better to establish continued ascendancy in fighter development in the crucial years from 1916 to 1918. The failure to do so was as attributable to their lapse into complacency as it was to Entente aircraft development.

In the late 1930s and 1940s, it took 3–5 years, not 6–9 months, to develop a plane from initial projects to front-line service. With regard to fighters, the Germans were able to enjoy qualitative equality, and occasional superiority, with the Me 109 and FW 190, and a clear superiority with the Me 262 jet fighter. Yet fighter development was once again marred by serious lapses – for example, the complacent notion early in the war that it could be won with the Me 109, which seems reminiscent of the over-reliance on the Albatros in the First World War. The Me 262 first flew in July 1942, but indecisiveness in granting it priority, compounded by Hitler's foolish decision to use the jet fighter as a fighter-bomber, a decision which may have been encouraged by Messerschmitt himself, caused the Me 262 to appear too late and in insufficient quantities to affect the outcome of the air war.⁴³

Perhaps the most salient failure of the RLM and the German aircraft industry lay in their development of second-generation types. As of 1941, the planes bearing the main burden of the war effort had emerged in the pre-Udet era, before 1937, and had entered mass production after a three-year sequence of prototype design and construction and three overlapping intermediate stages of test flying, preparation for serial production, and then the production of a small pilot series of aircraft. Udet unwisely attempted to reduce the time for the last three stages by a year and to begin mass production before completing flight tests, a truncation which led to repeated breakdowns and production stoppages of successful types like the Me 109F, the FW 190, and the Ju 88, and unsuccessful ones like the Me 210

and He 177.⁴⁴ Udet's mistaken policy was compounded by Goering's decision in 1938 and 1939 to select only a very few types for serial production before designs were sufficiently developed to judge their qualities.⁴⁵ Relying on untested and untried technology is invariably risky, as the British learned from their chastening experience with aero-engines like the ABC Dragonfly in the First World War. The policy would prove disastrous for Germany in the Second World War in the cases of the Ju 288, the Me 210, and the He 177, Germany's second-generation speed-bomber, heavy fighter, and strategic bomber respectively, forcing the excessive use of such types as the Ju 88.

In 1938 Heinrich Koppenberg, the blustery manager of the Junkers factory, persuaded Goering to order the mass production of the as yet untested Ju 88 as Germany's 'wonder bomber', a combination speed- and dive-bomber. When the international crisis prompted Goering to freeze models for mass production, his selection of the Ju 88 as the standard bomber for the early 1940s led to the largest pre-war contract offered the industry. As of 1 October 1938, of a total of 146,263 workers in the German airframe industry, 77,716, or 53 per cent, were engaged in Ju 88 production. The Ju 88 came to exemplify the *Baukastenflugzeug*, a standardised airframe capable of taking more powerful engines and heavy equipment, adaptable to different missions, and unifying several functions in one type. Yet this capability was purely fortuitous, for the RLM Technical Office's specification in 1934 for a multi-purpose *Kampferstörer* – a bomber, bomber-destroyer, reconnaissance, and close-support aircraft – had been superseded in 1935 with the one for a speed-bomber that the Ju 88 was designed to fill. What happened was that, pressed by wartime circumstances and the failure of other aircraft types, the Ju 88 ended by fulfilling the multi-purpose role. Its successor, the Ju 288, for example, was only expected to be available in 1943, as the RLM Technical Office waited on Junkers to fulfil its Bomber B requirement issued in July 1939, which itself had been based upon a Junkers proposal. After lengthy delays with the development of the Junkers engines, the Ju 288 never materialised, the Bomber B programme was aborted, and Koppenberg was fired.⁴⁶

Other crucial failures of the RLM and the industry were the Me 210, the second-generation replacement for the twin-engined fighter Me 110, and the strategic bomber He 177. As of August 1939, over a year after beginning design of the aircraft, Goering planned to have 3,000 Me 210s in service by April 1943.

The prototype's first flights in September 1939 were marred by extreme instability, which tests and modifications in the winter of 1939/40 did not cure. Yet by mid-1940 Me 210 airframes were in production. Later, after eighteen months of tests, service test pilots judged the Me 210 a vicious aircraft, while Udet's office, anticipating that the plane would reach squadrons by mid-1941 and reluctant to delay production to undertake major modifications of the plane, ordered the phasing out of the Me 110. Only in January 1942, after Messerschmitt had begun deliveries, was a production halt suggested after an investigatory commission recommended reinstating production of the Me 110 until the Me 210's problems were solved. Ironically, when production stopped in April 1942, modifications to the wing and rear fuselage had finally solved the instability problem, but too late to save the Me 210. Ultimately the modified airplane appeared as the acceptable but uninspired Me 410, but only in January 1943, two years later than originally intended.⁴⁷

In the case of the Heinkel He 177, tests in the autumn of 1942, nearly three years after the prototype's appearance, revealed that the Heinkel firm, which preferred to concentrate on the lucrative serial production of the obsolescent He 111 medium bomber, had done insufficient work to remedy wing weakness and engine overheating problems. The RLM assigned an engineer to the firm to reorganise the He 177 project. An He 177 modified according to the findings of his investigative team flew well during extensive tests in 1943, but by this time the modification of aircraft under production would have disrupted deliveries extensively. In any case it was too late for the plane to affect the course of the war.⁴⁸

In a final noteworthy case, the Focke-Wulf FW 190 programme was almost cancelled in 1940-1 because of the overheating of the BMW radial engines. Focke-Wulf blamed the engine for the problems, while BMW accused the aircraft manufacturer of paying insufficient attention to engine cooling in the original design. According to the technical officer at squadron JG26, which tested the plane, the solution to the problem lay in the collaboration between the airframe and engine manufacturers. The RLM delayed a final decision on the craft, and after some fifty further modifications, the FW 190A entered service late in July, to begin an auspicious career with the Luftwaffe as a fighter and fighter-bomber.⁴⁹

The pattern evident in all these cases was that the collaboration of the RLM Technical Office, the aircraft manufacturer and

the engine manufacturer was invariably necessary to solve problems of aircraft development. While it proved successful with the FW 190, the Ju 88, and other aircraft, in the cases of the Ju 288, Me 210 and He 177 the collaboration was inadequate and ineffective in 'ironing out the bugs' in the aeroplanes. Consequently, while aircraft production increased 50 per cent in 1942, it was of types that needed badly to be superseded by better aircraft which did not appear until far too late in the war.

The RLM and the German aviation industry could point to a number of successes, yet the failures may be more instructive, as the side that makes fewer failures or minimises and corrects them as quickly as possible is likely to win a contest of evenly-matched Powers. When the contest is lopsided, as was the case in Germany's struggle in the First and Second World Wars, the weaker side cannot afford the disastrous failures that Germany suffered in aircraft development from 1939 to 1945. In the First World War the inspectorate and the aviation industry did not experience such disasters, though they did commit crucial lapses in fighter development in 1917. In any case, the results were the same in both wars; Germany was overwhelmed in the air by her opponents' sheer weight of numbers, although her industry remained capable of superior technological strides, such as the Fokker D7 and the Messerschmitt Me 262, right to the end of the wars.

My overall conclusion to the comparison of the German aircraft industry in the First and Second World Wars is that the industry of the First World War performed better both quantitatively and qualitatively in comparison to its opponents than did the industry of the Second World War. While one might suggest that the opponents in 1939-45 were much stronger than they had been in 1914-18, the comparison of the industry's performance with that of Great Britain in both wars yields the same conclusion. German aero-engine development and production, and the failure of the government procurement and technical agencies to spur the aircraft-engine industry to better performance were limiting factors in both world wars that merit further study in depth. In both wars the industry deserved much credit for its achievements under adverse conditions ranging from increasing shortages of labour and raw materials to a devastating allied bombing campaign in the Second World War.

Perhaps the most appropriate place to end is where the paper began, with governmental leadership, since the development of

military aviation was a collaborative effort of government and industry directed by the government. Difficult circumstances placed a premium upon rational and resourceful planners and organisers capable of galvanising the industry to perform to the best of its technological and productive ability. The military leadership of 1908–18 generally did this better than their civilian–military counterparts of the Nazi regime from 1933 to 1945. One of the great ‘might-have-beens’ with regard to aeronautical developments in the Third Reich is what might have happened had Wever lived. Given the experience of other gifted professional soldiers such as his peer von Manstein, the conclusion is inescapable that even Wever’s great talents would ultimately not have sufficed to overcome the increasingly labyrinthine and demented state of the Third Reich.

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3

Stimulation and Attitude of the German Aircraft Industry during Rearmament and War

Willi A. Boelckc

Dependence on State and Market. The Situation at the End of the Weimar Republic

Right from its inception there was really no future for the German aircraft industry without profitable government orders, procurement orders for aircraft by the military and government-owned airlines, various state subsidies, state loans or loans secured by the government, and generous public funding. The aircraft industry could not depend on a large private market, but depended for most of its income on the government. Co-operation between the government and the aeronautical industry had never been completely severed during the Weimar Republic, despite production restrictions imposed by the Entente Powers. However, the ties had become much more delicate and, as soon became apparent, could in no way ensure the survival of all aircraft manufacturers during the world economic crisis.

The many problems that beset the aeronautical industry, the political restrictions, the lack of funds, the continuous technological and human shortcomings, the inadequate state subsidies and orders did not, however, discourage it.¹ In 1928, the budgets of the Army, the Navy and the Reich Transport Ministry showed non-recurring subsidies totalling 20,165,000 Reichmarks for the aeronautical industry.² When the ban on production was lifted in 1926, the German aeronautical industry experienced a rapid boom, and a passion for aviation of a scope hardly imaginable today took hold of Germany, an enthusiasm for all things

technological, which could only be compared to that in the pioneer days of new fields of high technology. These aviation enthusiasts thought they were establishing heaven on earth. But behind all the effort to establish aeronautical records and all pioneer feats of flying there was cut-throat competition among the many aircraft producers. Frequently, these companies had been set up in the heady atmosphere of the time, encouraged by the unwavering optimism of former war pilots and the technical obsession of the designers. Their belief in the future also had an infectious effect on businessmen, who were willing to take many risks. Traditional or burgeoning contacts were used to establish a market. An excellent means of advertisement were flying prizes or records, and aerobatics proved in many cases to be an important means of fund-raising.³

Until the early 1930s, investment requirements remained moderate.⁴ And above all, aircraft at that time – still technologically in the early stages – could be developed rather quickly. They were still relatively small and had only small engines, and there were no optimised standard designs. They were frequently only experimental craft, offering unlimited opportunities for the designers, and it was still possible to build them with the help of a sketchy drawing. Research and development costs remained modest. Some 8,000 man-hours were required for the mass production blueprints of the first real passenger aeroplane, the Junkers F-13 (four passengers).⁵ Working capital was tied up only for short periods in the semi-manufactured products, and was turned over several times a year. In 1927, Junkers at Dessau was the only large firm in the contemporary aircraft industry which carried out mass production. The other 17 aircraft producers of the time were medium-sized firms with a consolidated total production of some 200 aeroplanes. When Junkers regained its independence in 1927, after it had overcome the crisis in trade with Russia, it achieved a production output of about 100 aeroplanes.⁶

The medium-sized firms of the German aeronautical industry did not yet require large plants and a large administration, because they were still producing only small numbers of aircraft. Although Junkers was the world's most successful producer of all-metal aircraft, the layout of the plant at Dessau continued to be tailored to manufacturing experimental aircraft and small quantities. Of the most successful German aeroplane in the post-war decade, the F-13, Junkers sold, as records show, a total of 314 up to the end of 1939.⁷

Claude Dornier at Friedrichshafen, whose Metallbau GmbH was still part of the Zeppelin trust, put his stakes on the commercial success of his airships. Since the First World War, airships had been considered to be best suited to long-distance commercial flights. Of the airships of the Wal (whale) family, which soon became known all over the world, and were undergoing continuous refinement, a total of some 250 were built at Dornier yards or under licence in other countries, and they represented the very foundation of the firm. 'Yes, you can say the "whale" was what really got Dornier going.'⁸ In the million-mark venture of the Do X plane, the government was a secret partner, customer and funding organisation.⁹ The small-series commercial land aeroplanes that had been built since the early 1920s in various versions, including 50 Merkur aeroplanes, remained indispensable to the profitable operation of the firm (1928: 1,118 employees; 1932: 562).¹⁰ When the Dornier Metallbauten GmbH (of which the Zeppelin foundation, Friedrichshafen, held a share of 150,000 marks between 1924 and 1931) was approaching a low point in its company history in the world economic crisis of 1932, the shrewdly calculating Claude Dornier bought all the shares held by the majority owners at bargain prices. This made him the sole owner.¹¹

The Ernst Heinkel Flugzeugwerke GmbH at Warnemünde, founded in 1922, had 352 employees in early 1928 and built 29 planes in 1927/8, among them the successful HE 5 low-wing seaplane.¹² When Heinkel stepped up its expansion in 1931 with new orders, the company's capital assets amounted to 4 million Reichsmarks, plus hidden reserves of about 3 million marks.¹³ The sales in 1928 were estimated at about 2 million marks.

The Warnemünde plant, set up in 1917, of the Flugzeugbau Friedrichshafen GmbH became the Arado Handels GmbH in 1925.¹⁴ With 99 employees, it produced 16 training aeroplanes and the F-31 SDI one-seater fighter in 1927/8. The Focke-Wulf Flugzeugbau GmbH at Bremen, set up in 1924 by an engineer, a war pilot and a businessman with a capital investment of 200,000 marks, made it through 1927/8 and survived with 200 employees and a backlog of orders for over 16 planes. Production focused on small passenger aircraft, of which the A 17 Möve ('Seagull') became more widely known.¹⁵

Early corporate mergers benefited the Bayerische Flugzeugwerke at Augsburg, previously Rumpler, whose shares had been taken over by the Reich, although their financial problems

remained insurmountable. In 1926, the Udet Flugzeugbau, which had been transferred from Munich to Augsburg, was absorbed by the Bayerische Flugzeugwerke.¹⁶ In the following year, the Messerschmitt Flugzeugbau GmbH of Bamberg and the Bayerische Flugzeugwerke undertook a partial association and moved to Augsburg.¹⁷ Not counting the Messerschmitt administrative office, the Bayerische Flugzeugwerke had 227 employees in early 1928 and orders for 68 aeroplanes, 65 of which were U 12 'Flamingos' of the former Udet Flugzeugbau, a plane mostly known because of Ernst Udet's flying displays. At that time, Messerschmitt was building the M 18 monocoque passenger plane for the Nordbayerische Verkehrsflug GmbH, a plane that almost looked like a toy plane. The newly designed M 20 he had built for Lufthansa had crashed on one of its first flights. Another three out of a total of six such planes ordered crashed later because of a design flaw. The Bayerische Flugzeugwerke had great trouble avoiding bankruptcy until 1933.¹⁸

Bankruptcy proved unavoidable for such firms as the renowned Rohrbach Flugzeugbau (1929), the Raab-Katzenstein-Werke at Kassel and the Albatros-Flugzeugwerke GmbH, Berlin-Johannistal, which had been set up as early as 1909 and had had 158 employees working on the construction of 18 aircraft in 1927/8. Albatros eventually failed because of the high losses of trade with Russia, and left liquidation assets of 80,000 marks. Focke-Wulf took over the production facilities.¹⁹ When, in 1932, the cost-intensive Junkers engine production suffered the effects of the collapse of the Borsigwerke and the world economic crisis, the Junkers Company had to declare bankruptcy and file a petition for institution of composition proceedings. The balance sheet of 1931 showed an income of the Junkers plants of 11 million marks as against expenditures of about 42 million marks.²⁰

Less affected by the world economic crisis were the smaller companies producing light, small or sports aeroplanes, led by Hanns Klemm at Böblingen, who was the first in the category of light aircraft with small engines.²¹ Owned by Klemm himself, the 'Leichtflugzeugbau Klemm' started out in 1926 in Böblingen with a working capital of 3,000 marks from his own savings. The financial basis of the company improved in 1927 with a Reich subsidy of 100,000 marks and investments by personal friends to 155,000 marks, and was further boosted by an investment loan by the city of Böblingen of 80,000 marks and another loan of 100,000 marks by the State of Württemberg.²² With surprising

speed, the Klemm 'lights' found their way into the world of aeronautics as private trainers and sports and passenger aeroplanes. No other German or foreign company achieved greater export sales in this category. By 1930, more than 300 Klemm aeroplanes were flying all over the world. In the same year, right in the middle of the world economic crisis, Gerhard Fieseler of Kassel-Ihringhausen had achieved the independence of his 'Flugzeugbau Kassel' company. Much like Messerschmitt, he began by building glider planes for sports pilots. In 1933, he made the transition to mass production of single-engine sports aeroplanes.²³ The revenues from aerobatics were indispensable to the entrepreneur Fieseler.

In the light of international developments, there was no reason to claim a German lead in aeronautics in 1932/3. In commercial aviation, Junkers and Dornier enjoyed a world-wide lead thanks to the experiences they gained through specialisation. This also applied to the construction of all-metal aircraft. The majority of German aircraft designs before 1933 had not exceeded the design standards of the First World War. They required little effort and few designers and draftsmen.

A conventional biplane with cloth-covered steel fuselage and wooden wings was, as Heinkel recounted in his memoirs, something you could sketch on a coaster when having your nightcap, and you could get into the air within two months.²⁴ In the early 1930s, the Heinkel company built almost exclusively cloth-covered biplanes with steel fuselages and wooden wings.²⁵ But this was not what the future called for. Heinkel had specialised in the development of aircraft catapults, with the secret assistance of the Reichswehr, since the 1920s.²⁶ The model development of Lockheed brought, in February 1932, a development order for Heinkel to build a fast plane for Lufthansa, a development that led to the aerodynamic He 70.²⁷

Airframe construction and the development of aerodynamic aircraft configurations received new impetus from the German light-aircraft industry. However, owing to the ban on production of powerful engines, since engines determine the performance of the aircraft, the German aircraft-engine industry had fallen hopelessly behind international standards: progress made in airframe construction could not be exploited because of the inadequate engine performance.²⁸ Annual subsidies of more than one million marks from secret budgets of the Reich also failed to bring about substantial successes.²⁹ Furthermore, no German aircraft company was able to go into large-scale

production, and Junkers even explicitly rejected that notion.³⁰

Control of the Aeronautical Industry during the Rearmament Phase

After Hitler came to power in 1933, the Luftwaffe command under Goering began by setting up a so-called 'high-risk air force' in the phase of covert rearmament which lasted until March 1935. This was based on the principle that 'one would not, at some later date, procure the best conceivable aircraft or weapons and equipment, but produce the already developed equipment, which could be produced at short notice, on as large scale as possible'.³¹ Quantity was the objective, i.e. raising as many units as possible with aircraft straight from the factory; quality, the state of the art of technology and performance standards in air armament fell completely behind it. This decision was problematic in many respects.

Although aircraft manufacturers could foresee fat government orders and an end to the continued fear of a production which was far below actual capacities, it is safe to say that the majority of German aircraft manufacturers in 1933 did not give the government-initiated armament boom an enthusiastic reception.³² There were several reasons for their reservation and scepticism. German aircraft firms, being a new addition to industry, could not be compared with traditional heavy industry. Until 1933, aircraft firms, with their limited, medium-sized business structure and performance, their corporate strategy designed for a 'fringe' market, and their small capital base, were designed to be run by one man at the top.

Calls from the Luftwaffe command for the speedy production of a maximum number of under-tested older-type military aircraft from 'another age', usually cloth-covered and with wooden supports, propelled by low-performance engines, placed aeroplane manufacturers in an unprecedented situation.

The consequent expansion of the companies would commit and absorb much manpower and capital for years, impose great financial demands and give rise to fears of new and dangerous risks, even on the question of the continuity of the workload for the expanded production base. There were also fears of too much unprecedented interference by the government in the industrial decision-making process, which would eventually force manufacturers to abandon their previous manufacturing

concept, the design of a development plant, or their export policy, and especially the concept of small production runs. The young aircraft industrialists showed marked self-confidence and were proud of their independence. 'We will not be guided by Lufthansa's desires but by the needs of the world market', was the motto Professor Junkers proclaimed as late as 1931.³³

Most of the aircraft manufacturers were untiring inventors obsessed with their ideas. Outsiders more than anything else, they were frequently inaccessible, but persistent and strong-willed individuals. They did not come from the established industrial families, but were the *homines novi* of a new industry whose rise was very much due to their achievements. Some were untiring inventors with little business acumen, others were extremely smart businessmen, and almost all had gained experience abroad. Political affiliations were usually incompatible with their way of life and work, and they were the worst choice as sponsors of the Nazis before 1933. After that date they became members of Hitler's party without really becoming enslaved to it. Only Willy Messerschmitt had connections within the party and the SS all the way up to Hitler's deputy, Rudolf Hess.³⁴

Putting the German aeronautical industry on the road to rearmament meant that the Luftwaffe command had to gain the support of industry initially by providing money, by persuading reluctant manufacturers, and sometimes by applying pressure and, if necessary, replacing private owners with government-appointed managers. The people around Goering seem to have been aware of these alternatives from the outset, and were determined to take these measures.

The peremptory and brutal action of the Luftwaffe High Command, immediately after Hitler's take-over, against the ingenious Professor Hugo Junkers (1859-1935), who was the most important living pioneer of German aeronautics before Claude Dornier (1884-1969), and the head of the not very well-off Junkers holding in Dessau, which had gone bankrupt – the way he was stripped of his powers and shamefully placed under house arrest, the most shabby reprisals against him³⁵ – were all related to the secret rearmament plot. The Reich needed the largest German aircraft and engine manufacturer, and access to the numerous basic patents of Junkers without any constraints and security risks. Although private financing and rehabilitation possibilities for the Junkers plants – similar to those for the bankrupt Borsig company – did exist and were recommended by

various parties, the military leadership successfully called for government intervention, reasoning that the need for maintaining security was crucial, and this led to the firm losing its independence. In late 1933 Professor Junkers also faced political discrimination as a former member of the German Democratic Party, was forced to resign from the directorship of his two plants, and was exiled from Dessau to Bayrisch Zell, where he was put under house arrest.³⁶ In 1933 the Junkers plants produced only 41 aeroplanes and could not be drawn upon for the rearmament effort. In a last-ditch effort, the old and sick Junkers continued to delay the cession of his plants to the government. The contracts only took effect several weeks after he died in 1935. The Reich Aviation Ministry took over the Junkers plants for a total of 27.12 million marks' compensation, plus 3.5 million marks for the utilisation of Junkers patents for aeroplane and engine construction.³⁷

Hugo Junkers was undoubtedly the most prominent but not the only victim of the process of 'co-ordinating' the German aircraft industry to put it on the road to rearmament. In 1933 the co-founder and Technical Director of the Focke-Wulf Flugzeugbau GmbH in Bremen, Heinrich Focke (1890-1979), a great inventor and an excellent practitioner, was, for political reasons, also removed in 1933 as head of his firm, which was to play another key role in air armament.³⁸ Within his firm, he was given a research institute, where he developed the world's first operational helicopter, the Fa 61, by 1936. Now he was needed again, and was allowed to found the Focke, Achgelis & Co GmbH, at Delmenhorst, in 1937.³⁹ To get military orders, the firms of the aeronautics industry had to meet the political and military requirements of the Reich Aviation Ministry, and to impose restrictions on staff policy.

On 1 December 1933, Carl Clemens Bucker (1895-1976),⁴⁰ who had founded the Bucker Flugzeugbau GmbH at the traditional location of the Berlin aeronautical industry, in Berlin-Johannistal, upon his return from Sweden in October 1933, was told by a representative of the Reich Aviation Ministry that Bucker Flugzeugbau, even if it produced a serviceable military plane, would not be awarded a mass-production procurement contract because of foreign capital investments in the company (the Ambi-Budd presses), which were a security risk, and because the location of the plant at Berlin-Johannistal was not suitable. Apparently, Bucker did not regard government orders, which were a kind of access to the 'Reich feeding

troughs, as desirable at the time, and he replied 'that under these circumstances, he would try to keep the firm going with private orders only, as Fieseler and Gerner were doing, who had a good workload at the time'. In late 1935, he moved the firm to the advantageous and, for the military, more suitable town of Rangsdorf near Berlin; but he stuck to the construction of sports and training aeroplanes.

In Böblingen, Hanns Klemm, too, was disappointed to discover that the heyday of light aircraft and peaceful sports flying was over in the 1930s, that aircraft were now only being judged on the basis of their suitability for the military, and that his independence as an entrepreneur was gradually being eroded.⁴¹ To compensate for the loss of foreign orders, Klemm was to be given repair work on training aircraft of other manufacturers and, in addition, was to build a branch plant at Halle/Saale for strategic reasons, which was then turned into the Siebel company shortly after it was opened. Not unlike Bücker, Klemm also managed to stay in business with aircraft designs of his own as long as they could be used for training by the military. This was the reason for the success of the Kl 35, several hundred of which were even produced and exported to foreign air forces in 1938/9. At that time the Reich Aviation Ministry approved large-scale aircraft exports despite its normally very restrictive practice. Not exactly 'to the liking of the self-confident and independent-minded' Klemm, the Ministry also continuously controlled and monitored 'the number of employees and the performance indicators' of the plants.⁴²

Nothing of the opposition to the new regime at the head office of the Dornier Corporation in Friedrichshafen reached the public, but again, there was mounting antagonism. The dispute was due to design problems and export management. In 1933 the first thing the new Luftwaffe command did was to place a large order for a total of 192 bombers and 183 trainers with Heinkel, Focke-Wulf, Arado, the Bayerische Flugzeugwerke, Leichtflugzeugbau Klemm, Junkers and Dornier. The order placed with Dornier included the Do F, built since 1925 as a mail and cargo aircraft, and now revamped as an auxiliary bomber, the Do 11, developed from the former, and the famous Do Wal.⁴³ The hasty transition to the mass production of Do 11 and Do 23 bombers resulted in set-backs because these aircraft had not been tested exhaustively, and led to some trouble. Trouble also arose on account of the attempt by the Dornier management to preserve the traditionally active export policy of the

firm, backed up by Reich funding to cover its own cost risk. Already in December 1933, the firm put in the first export authorisation request for the Do 17 high-speed plane, initiated by the Reich Aviation Ministry, although development of the plane had not yet progressed to the production stage. Almost 1.7 million marks, a sizeable sum at that time, figured in Job Creation Programme IV for the two ordered prototypes. Not until August 1935 did it pass the type test conducted by the Luftwaffe, and in late 1936 this was followed by the official order for another eleven test aircraft.⁴⁴ This had, however, been preceded by an angry outburst from the Reich Minister of Aviation and Commander-in-Chief of the Luftwaffe, Goering, who, in a letter to Claude Dornier dated 1 September 1936, gave vent to his indignation at the firm's export desires: 'Even in the past year the management of exports, for which Mr Mayer is responsible in your company, required detailed instructions from the Chiefs of the Technical Office and the Central Division, Generals Wimmer and Wenninger. In spite of this, the pending negotiations on the sale of Do 22 and Do 17 aircraft show that my wishes were not given due consideration.'⁴⁵

In Rostock, the initial generosity of the party leader of Mecklenburg, Hildebrand, towards the Swabian aircraft producer, Heinkel, turned into 'distrustful, grudging resentment' and eventually culminated in interference in the personnel management of the company owner and extremely serious hostility towards Heinkel.⁴⁶ However, the lucrative financial offer of the Technical Office of the new Luftwaffe caused the independent-minded Heinkel to refrain from immediate opposition. In June 1933, Albert Kesselring, Chief of Luftwaffe Administration, allegedly offered him 'a basic principle which appeared appealing: minimum intervention in private industry, strictly limited state subsidies, and emphasis on letting the industry work and make profits by offering adequate pay, thus giving it the possibility of repaying these loans, which were really indispensable for development of new designs from their own resources and as fast as possible without functioning as chains'.⁴⁷ Such attractive business prospects had the desired effect on aircraft producers, who faced the same management calculations as any other businessman.

An armament boom induced by increasing demand and catering to the interest in profits was bound to boomerang after a short time against its originators. After 1936, the hectic, hasty rearmament confronted the Luftwaffe command with the

dilemma of inflation. At a meeting at the Reich Aviation Ministry on 16 June 1937 with representatives of the air-armament industry, Goering did not hide his displeasure.⁴⁸ Similar outbursts of Goering's wrath over the alleged failure of the air armament industry would recur during the Hitler regime. At the same meeting in 1937, Goering expressed his 'great regret that the military and the political situation had forced him into this concentrated armament effort, which, in his opinion, resulted in the Reich being blackmailed into paying exorbitant prices'. The assumed predicament of the Reich Aviation Ministry had apparently convinced the industry that it could increase its prices. Therefore, he was not able to commend the industry. 'Full praise is due only for a good job, but not for an effort where the result is not commensurate with the price.' Examples of 'outrageous pricing' were quoted by Ernst Udet, the Chief of the Technical Office of the Reich Aviation Ministry, who was also present.

The accusation that the air-armament industry had basically produced bad quality at high costs also applied to the Luftwaffe command itself. A high price had been paid for the questionable experiment with the 'high-risk air force' set up between 1933 and 1935, with approximately 1,800 aircraft, obsolete equipment at best suitable for training; granted, no 'old stringbags', but basically no more than one big military bluff. For years they had used obsolete technology, including much manual work to produce large numbers of outdated aircraft, frequently using semi-skilled labour,⁴⁹ without making any progress towards mass production of aerodynamically sophisticated all-metal aircraft with powerful engines on a par with foreign aircraft engines, and with adequate armament. Only in the course of 1934 did mass production of the good, old, slow Ju 52 start in Dessau.⁵⁰ The more an armament industry conjured up from nowhere, with an inadequate initial basis and inadequate production potential, was forced to expand its production basis, while simultaneously undertaking great development efforts and having to fulfil at all times the various requirements of government procurement agencies, as well as responding to the bureaucracy and controls of a huge military administrative apparatus, the more one can understand why costs went up, and why the businessmen tried to compensate for their risks by hiking up prices. A largely distorted price-performance ratio was the inevitable consequence. Even an aircraft manufacturer like Hanns Klemm in Böblingen, who was not regarded as a

very shrewd businessman, submitted an estimate to the Aviation Ministry for one K1 25 with special equipment (value: 15,965.45 marks) in which materials and wage costs were the smaller part of the bill, whereas additional costs and expenditures and the profit margin amounted to a total of more than 61 per cent.⁵¹ In a letter dated 30 August 1938, Ernst Heinkel gave as the result of the price audits made by the Aviation Ministry for the four-year period 1933 to 1936 a business volume of 147 marks. Since he had to repay the government 18.5 million marks in excess profits, as had been determined by the audit, he even incurred losses of 243,000 marks for that period, and accordingly complained of financial abuses perpetrated against his firm and requested relief from the debt of his plants 'at least to an extent that would re-establish the situation of early 1933'.⁵²

The older aircraft firms were forced to expand because government orders exceeded their capacities. Fast expansion of plants and the construction of branch factories increased the influx of external capital, leading to profit problems despite the relief of short-notice depreciation guarantees. The Dornier trust had increased the number of employees in its plants in Southern and Northern Germany (Friedrichshafen, Oberpfaffenhofen, Neuaußing, Wismar, Lübeck, Langenargen) to 8,245 by January 1936, a 1,367 per cent increase over 1932. With substantial financial subsidies from the Reich, air-armament plants, still under the traditional company name, expanded, and had, as Heinkel put it, 'to dance to the tune of the investors'.⁵³ Especially the Luftwaffe made an effort, as General Georg Thomas, an expert on the subject, wrote in 1943-4, 'to create military-owned plants, partly for security reasons, partly from the false notion that a government-owned industry works more cheaply and more responsibly, but also in part for reasons of interministerial rivalry'.⁵⁴ The Heinkel-Werke GmbH, set up in 1936 in Oranienburg near Berlin for the sole purpose of producing the He 111, were a Luftwaffe-owned aircraft producer until 1941, just like Junkers at Dessau. The basic capital assets of 5 million marks were owned by the Reich, while Ernst Heinkel was granted a share of 150,000 marks, 'in recognition of his efforts in the establishment of the plant'.⁵⁵ Consequently, Heinkel did not become manager of the plant. He was only given a certain influence through his job as chairman of the firm's advisory committee.

Because existing aircraft plants and their expanded capacities were still unable to provide the Luftwaffe with large numbers of

the aircraft it desired, the Technical Office of the Reich Aviation Ministry sought a remedy by awarding licences or contracts. Widespread use of production under licence had already become important before the war, and became even more so during it.⁵⁶ Since 1933 a number of renowned firms in the metal industry, with suitable production facilities but currently operating below full capacity, had been asked by the Reich Aviation Ministry to contribute to the build-up of the Luftwaffe. Furthermore, abandoned or bankrupt firms were reactivated. On the North Sea coast, the shipyards of Blohm & Voss, Hamburg, and the Schiffswerft AG Weser of Bremen began to produce aircraft. In central Germany, the ATG (Allgemeine Transport-Anlagen-Gesellschaft) in Leipzig, the Erla Maschinenwerk of DKW, which had been relocated to Leipzig,⁵⁷ and the Lokomotivfabrik Henschel in Kassel and in Schönefeld near Berlin, as well as the Gothaer Waggonfabrik AG of Gotha,⁵⁸ the MIAG in Brunswick (Braunschweiger Mühlenbau und Industrie GmbH), the AGO-Flugzeugwerke GmbH at Oschersleben,⁵⁹ a subsidiary of the AEG, and the AEG plants in Wildau near Berlin⁶⁰ became important aircraft manufacturers. The first procurement order placed by the Aviation Ministry with such firms constructing under licence was known as a 'practice order', because it served to train the firm's personnel in aircraft construction. Medium-sized companies, such as Bachmann in Ribnitz-Mecklenburg,⁶¹ were given a chance as producers or suppliers of parts.

But the greater number of the firms involved in the contracting-out of production were generally not very ambitious, and refrained from making large capital investments, although some tried unsuccessfully to use free capacities from the production under licence for developments of their own and construction of their own designs.⁶² The objective of the primary contractors of restricting their own investment to a minimum, despite increases in costs, is also reflected in the efforts of the firms constructing under licence to find suppliers for certain components. All in all, the good intentions did not bring much success, since only a small portion of the investments of 2.35 billion marks made just before the outbreak of the war in 1939 belonged to the companies themselves. Some 52.6 per cent was company assets and bank loans, but another 47.4 per cent was covered by shares and loans of the Luftkontor GmbH or government funds.⁶³

The distribution of the production of parts among many suppliers or subcontractors was encouraged by the government's

pricing guidelines. From 1936 to 1943 armament orders were placed with the industry on the basis of calculated or estimated 'fixed prime cost prices', 'recommended prices' and 'prime cost compensation prices'. The prime cost compensation prices functioned as a kind of economic cushion. The biggest, and apparently most widely exploited opportunities to make profits in this system rested – as the government auditors found to their amazement only in 1941/2 – not with the final assemblers, who were subject to audits, but with the suppliers and subcontractors, who had not been subject to audits, in particular before the war. Suppliers' prices were incorporated into the final assembler's calculation without any attempt on the part of the latter to reduce them.⁶⁴

Another weak spot which contributed to the cost explosion in air armament was pointed out in a memorandum by the Representative to Berlin of the Bayerische Flugzeugwerke in February 1937, which bore the frank title: 'Factors Dictating Unproductive Management in the Aeronautical Industry'. It also pointed out that the sharp rise in unproductive costs was due to the declining skills of the employees. Because of the shortage in labour, companies had to hire and retain many unskilled or inadequately trained workers who 'would have been laid off in normal times without hesitation as unfit and inadequate'.⁶⁵ This situation continued to develop on the same scale during the war. Man-hours were lost through the employment of workers with no experience of aircraft production,⁶⁶ through periods of idleness and through raw material shortages and defaulting on the supply of parts.

Like a leitmotiv, complaints by final assemblers about shortages and late deliveries of supplies, materials and labour shortages, recurring problems with procurement of the desired aircraft engines, the fluctuating workload⁶⁷ and many other things, marked the history of German air armament from 1935 to 1945. As early as 9 February 1935 Henschel at Kassel cautiously put this on record: 'We stated that the problems of material for the Do 13 would upset production and probably leave the affected workers temporarily without work'.⁶⁸ The shortage of German raw material resources and foreign currency in 1936/7, caused by the rearmament of the forces, was sending out initial tremors.⁶⁹ There were increasing complaints from aircraft and aircraft-engine producers about insufficient supplies, inadequate machinery and a shortage of trained workers.⁷⁰ Thus, BMW in Munich, one of the most important

manufacturers of aircraft engines, temporarily reduced the weekly work schedule to 40 hours. On 20 January 1937, Dornier wanted to secure follow-on procurement with its Do 17, and hoped 'for preference of the Do 17 over the He 111 because of simpler production requirements and, consequently, production of the Do 17 at Wismar'. Since the Luftwaffe's peacetime procurement objectives had all but been filled by 1937, industry was pushing for placement of the follow-on procurement programme. On 8 February 1937 the Under-Secretary of State for Air, Erhard Milch, decided 'that the follow-on programme must be carried out despite raw material problems. Delays caused by shortages of raw materials must be accepted'.⁷¹

As a final consequence, a mixture of retarding factors, the hectic rearmament with a technologically underdeveloped industrial potential, the foreseeable general economic shortages and the bureaucratic controls of industry resulted in a significant increase in costs in the German air-armament industry. This manifested itself primarily in disproportionate labour costs, which in turn indicated a less than full workload for available capacities. At the meeting at the Reich Aviation Ministry on 16 June 1937 Ernst Udet also mentioned the considerable number of man-hours. To build a single-engine aircraft in Germany still took between 10,000 and 15,000 man-hours (excluding research and development), a twin-engine aircraft even between 20,000 and 25,000 man-hours, he said. This was no exaggeration. Blohm & Voss took 58,333 man-hours for the day bomber Do 23, and almost 35,000 man-hours for the older Ju 86.⁷² As a result of these high production costs, the German aircraft industry was hopelessly inferior to foreign industry, and in no way competitive in prices. According to Udet a twin-engine bomber cost 300,000 RM in Germany, just the airframe of a fighter (without the engine) cost 130,000 RM, while foreign competitors could provide a good fighter for as little as 90,000 RM. In 1934/5 the Luftwaffe paid 500,000 RM for a twin-engine He 111, in late 1939 it was offered to Hungary for no more than 332,000 RM.⁷³ For the He 112 fighter, a figure of approximately 130,000 RM was quoted as a basis for negotiations, and a figure of 160,000 RM for the Me 109.

German aircraft export, normally controlled by the Reich with foreign policy considerations in mind, generally involved great financial losses until 1939.⁷⁴ It was claimed that only Me 109 fighters were not sold below cost price, while all other aircraft were sold at 40 per cent discount, financed with government

subsidies. As German price levels were above world-market prices from the outset, the competitiveness of German exporters was considerably reduced. Tough price competition on the international aircraft market may have further reduced the chances of German suppliers. A German report of 27 February 1939 on exports of aeronautical equipment noted: 'The fight for exports is quite a brutal and unfair one with all foreign supplier countries. And our political friends are no exception.'⁷⁵

Despite tremendous increases in the Luftwaffe budget, the cost-benefit ratio in air armament had dropped significantly. Taking the increase in production output as a yardstick, the ratio dropped consecutively from year to year in the period from 1933 to 1939. Compared to the previous year, the production increase in air armament over the relatively low initial base was 80 per cent in 1935, and fell to 60 per cent in 1936 and to about 10 per cent in 1937.⁷⁶

From 1933 to early 1936 (including the financial year 1935/6), the actual expenditure of the Reich Aviation Ministry amounted to 1.75 billion marks, plus a similar sum financed through the secret Mefo scheme.⁷⁷ When the replacement of obsolete aircraft began on a very modest scale in 1936, air-armament expenditure was doubled.⁷⁸ Only in 1937 did the large-scale conversion to 'second-generation' bombers and fighter aircraft gain momentum (Do 17, He 111 and Me 109) and this momentum continued until the outbreak of the war. During almost four years of modernisation of the Luftwaffe and expansion to just under 4,000 operational aircraft,⁷⁹ the actual expenditure of the Reich Aviation Ministry soared to a total of approximately 17 billion marks. The relatively long duration of the conversion of the Luftwaffe, despite huge investments of capital and the political leadership's pressing for war, as well as the failure to develop a heavy four-engine bomber in the German Air Force because of the aircraft-engine problem, which remained unsolved despite all assistance,⁸⁰ was, for the most part, due to existing production problems in the German air-armament industry and its sometimes outdated technical production processes. At the beginning of the war in 1939, Germany had the strongest operational air force in the world, but not the most modern and capable air-armament industry.

Control in War

One of the most difficult tasks of modern arms development is to produce a clear idea of the probable life-span in war of an in-service aircraft and its ageing process, and to time the necessary transition to modern weapon systems. Even before the war the German Air Force High Command displayed a rather conservative attitude. Their clampdown on the innovative activities of industry became more pronounced during the war. A major contributing factor was the fear that the proficiency of the military would not keep pace with the technical progress provided by the industry. This fear had already been expressed by the Luftwaffe Director-General of Air Armament at the above-mentioned meeting at the Reich Aviation Ministry on 16 June 1937. Bombers with a speed of over 500 km per hour were, in his opinion, useless for the fighting forces. He did not waste any time considering the introduction of a 'third generation of aircraft'.

He told the aircraft-industry managers present, 'The firms, therefore, can take their time to formulate thoroughly new projects.'⁸¹ A few days after war broke out in September 1939 this reassurance was gone. A directive called for the cancellation or reduction of 29 aircraft projects.⁸² This meant that the production of FW 200 B (Condor) was to be cut to 20 aircraft; but only a short time later, prompted by a Japanese enquiry, this commercial aircraft unsuitable for combat employment was turned into the only serviceable four-engine long-range bomber of the Luftwaffe (FW 200 C, 262 built) by installing weapons.⁸³ Work on the Ju 252 and Dornier's dive-bomber project was stopped altogether. By April 1942, the production of some 250 Do 217 aircraft, the souped-up successor to the too-weak Do 17, was to be finished, although the first test model had not even taken to the air. Instead of being used as a bomber, as planned, the Do 217 had by 1942 become the Luftwaffe's standard night fighter.⁸⁴

The vicissitudes of German air-armament in 1940-41 are a rather obscure chapter of the Second World War, not least because of the gaps in usable sources. They are full of contradictions and discrepancies, often implausible and also overshadowed by the suicide of the Luftwaffe Director-General of Air Armament, Udet, in November 1941.⁸⁵

Even during the first months of the war, a shortage of skilled workers and supplies hindered and delayed an increase in

production to wartime requirements.⁸⁶ Not only were the aircraft types which had been developed around 1936 and which represented the striking power of the Luftwaffe at the beginning of the war, i.e. the Me 109 and Me 110, the Ju 87, the Do 17 and the He 111, mass-produced in 1939 and 1940, but in the years that followed there was a substantial increase in production from 1939 to 1940 from 2,518 aircraft to 10,247, i.e. an increase of 307 per cent,⁸⁷ one reason being that these were mass-production programmes that had progressed beyond the initially problematic start-up and modification phases characterised by increased adaptation efforts. Consequently, the required production times had generally dropped to the lowest average for the respective aircraft type,⁸⁸ although it would reach still lower levels during the war and until production finally ceased. The Wehrmacht price of a He 111, for instance, stood at 330,000 marks in 1939, and could be reduced to 110,000 marks by 1944 owing to streamlining of production, weight reduction and 'de-refining'.

Most probably, the conviction, in the early summer of 1940, that victory was imminent and the fear of prolonged conversion of production facilities, with temporary shut-down of production, prevented the Luftwaffe command from taking the much-needed measures for full extension of the mass production of 'third-generation' fighters and bombers. In place of this, supply-continuity programmes were initiated in the summer of 1940, and many aircraft plants worked on them for up to one year: among them, the Arado-Werke at Warnemünde; the Fieseler-Werke, which even worked on supply continuity for the Fi 156 until March 1942; the Siebel-Werke at Halle, which worked on the Si 204 D passenger and training aircraft; the Metallwerk Niedersachsen Brinkmann & Mergel, on the BV 138; the Weser-Werke, and many others.⁸⁹ The need for swift action, acceleration of conversion and an increase in aircraft-production figures was obviously not realised by the 'air-armament barons' of the Technical Office of the Reich Aviation Ministry until early 1941, when preparations for the Russian campaign had to be made against the background of defeat in the Battle of Britain.⁹⁰ The successor to the Me 110, the Me 210, whose type classification had, in June 1939, been given the low construction-guide parameter of 4,610 man-hours for initial assembly without weapons, proved to be a design failure. Mass production of the standard bomber Ju 88 had been delayed, and did not begin until 1940.

Aircraft were the most complicated and most rapidly chang-

ing weapons in the Second World War.⁹¹ The experience of German industry was that a new model needed three to four years to get from the design stage to the mass-production stage.

One of the first moves by the Luftwaffe command to deal with the slowly emerging crisis in the German air-armament industry was to expand its influence on the air-armament industry by enlisting the assistance of an obviously supportive industrial management. In the overall organisation of the Luftwaffe, aircraft producers, who had not been exposed to the pressures of the market, had so far played a negligible role. Goering's personal relationship with the aeronautical industry had been notoriously bad since the 1930s. The industry was expected to comply with the production directives of the military authorities promptly and without protest, as if they were military orders. On the other hand, National Socialism did not enjoy the blessings of industry. However, the incompetence of the Luftwaffe command in matters of industrial production left the industry some room for manoeuvre, where private interests could be cultivated. A pricing policy advantageous to industry as well as generously paid development contracts seem to have been no incentive to industry to move ahead with capital-intensive streamlining of production. Existing know-how was therefore applied more to development than to building assembly lines. This resulted in underdeveloped production-line technology, which proved a considerable hindrance, particularly in 1941, to the further expansion of production in the aircraft industry.⁹² The Industrial Council set up by Goering on 14 May 1941 as the Reich Marshal's Industrial Council for Air Force Equipment was to be an instrument for increasing the output of the industry. Under the chairmanship of the Luftwaffe Director-General of Air Armament, Udet, seven representatives of industry were appointed members of this advisory body: two directors of the Auto Union AG, Chemnitz, William Werner, who had gained experience in America, and Richard Bruhn; Heinrich Koppenberg, who had been given special powers for the acquisition of light metals for the Luftwaffe; Kurt Lange, the Counsellor for the Four-Year Plan in machine production; the assistant plant manager of the Henschel plant at Schönefeld near Berlin, Carl Frydag; AEG Director Hans Heyne; and the Director-General of Büssing, Rudolf Egger, at the same time head of the motor-vehicles group. It is likely that the composition of the advisory staff caused some surprise, because neither owners nor managers of the big aeronautics firms and the important aircraft-

engine producers were asked to join. A later correction of the composition of the Industrial Council resulted in substantial changes; but this body left hardly any permanent trace.⁹³

When Hitler, ecstatic about the triumphant first weeks of the Russian campaign, ordered in the directive of 14 July 1941 that 'the focus of the armament effort' be shifted to 'a large-scale expansion' of the Luftwaffe, thus giving the green light for the 'Goering Programme' of late June 1941,⁹⁴ the entire planning for the Luftwaffe was still almost unbelievably utopian, and this in no way reflected the reality of production in the air-armament industry. A forced increase in aircraft production from 1,200 warplanes a month to 3,000 was completely unrealistic. In late October 1941, Milch submitted a much reduced, but realistic, air-armament programme at a meeting with General Thomas and the Director of the Auto Union, Werner. Milch's planning target for 1942 was the production of 16,500 warplanes, and for 1943 he called for 20,600, an increase over the previous years of 33.0 per cent and 24.8 per cent respectively. These figures were not quite reached in 1942, but significantly surpassed in 1943.⁹⁵ Werner was given the opportunity to voice his harsh criticism of the backwardness of production methods in the German air-armament industry. His remarks about stepping up production output, while simultaneously decreasing the input were not without consequences. It 'was wrong to pay any price, because a higher price entailed more expenditure, which meant in turn that more manpower and material were required than with cheaper production methods, that is, production with less expenditure'. Such ideas, which ran contrary to those of industry and the development trends of contemporary high technology, found their way into the 'Fighter Board' (Jägerstab) under Milch and Saur in 1944.

In general, design and production of aircraft were consuming more resources as technical development progressed and brought new problems, which resulted primarily from the sharp increases in flying speed. The development of the Ju 88, for instance, with an engine of 2,440 hp, took 177,029 hours in 1938; whereas in 1940, the new high-performance bomber Ju 288, with a 4,000 hp engine based on an entirely new development philosophy, took 618,700 hours.⁹⁶ Production of the high-performance aircraft consequently required much more work.

Reflecting the system of supervisory boards set up by the Reich Ministry for Armament and Munitions, the Reich Aviation Ministry began mobilising industry in October–November

1941 for more extensive participation below the level of the Industrial Council by creating production combines within the German aeronautical industry.⁹⁷ These combines were headed by a lead firm. Primary and Special Combines, as established shortly afterwards under the auspices of the Speer Ministry,⁹⁸ were industrial bodies for control and co-ordination of parts suppliers, and had to deal with the problems of the suppliers/subcontractors. By April 1942, a board system for production in the aeronautics sector had been set up, comprising three main Boards (airframes, under Frydag; engines, under Werner; and aircraft equipment, under Heyne), and subdivided into 46 Special Boards. This board system was to increase industrial performance by 'making the best use of the technical, organisational and economic experience of the armament firms'.⁹⁹ At least in the Special Boards, the selfish interests of the firms were felt strongly, and, at the same time, exposed the chaos in model policy, which continued after the death of Udet. The Special Boards working on airframe construction, organised on the basis of the aircraft types currently in production, had to upgrade production of 26 different aircraft types; but among those there was hardly any aircraft that could serve to demonstrate German superiority in the air.¹⁰⁰

Industry did not have a direct influence on the aircraft-model policy of the Luftwaffe, which did not mean that industry representatives did not repeatedly try to influence the decisions of the military by pointing out the advantages of their respective aircraft models. The reluctance to make any sudden, though necessary programme changes in the mass production of aircraft – already felt in the final days of the Udet era, in which the mass production of the FW 190,¹⁰¹ an aircraft superior to the Me 109 began – became even more pronounced in the subsequent Milch era, because the conversion to a new series, a new aircraft model, invariably meant a steep rise in production man-hours and increased change-over efforts.

Milch's system of organising the planned production hike was mostly based on committing more labour to expand the mass production of old types of aircraft. He thus limited his effort to producing old aircraft or aircraft rendered obsolete by the war, such as the Me 109, Me 110, He 111, Do 217, Ju 88, Ju 87 and Ju 52, with more powerful engines and modern weapons. In the final analysis, this attempt to keep up with developments in arms technology and compete successfully with their adversaries failed. Streamlining of production and the introduction of

assembly lines had resulted in a significant decline of production times for older aircraft models since 1942, with savings in manpower and materials and a remarkable increase in output.¹⁰²

The quality of the aircraft produced remained a bone of contention between the military and industry. Instead of trying to make some headway in the construction of the most modern, superior developments, efforts were made to improve the arms of yester-year, in many cases in unfavourable conditions. During the Milch era, which lasted until May 1944, none of the high-performance aircraft of the 'fourth generation', i.e. the wartime developments with Otto engines, the Ju 288, Me 209, Do 335, He 277, progressed beyond the production stage.

It cannot be disputed that after 1942 there was mounting tension between the manufacturers and the Reich Aviation Ministry and that there were increasing conflicts and growing resistance to the model policy and the technical requirements and directives of the Luftwaffe command. In September 1942 Goering once again summoned the aircraft manufacturers to give them a dressing down over the production backlog. He also threatened to nationalise the industry and dismiss top managers. It was becoming increasingly impossible to speak of trustful co-operation between the Reich Aviation Ministry and the firms. Willy Messerschmitt had strongly criticised the air strategy and production programmes of the Luftwaffe command. As early as May 1942, he was relieved of his post as Chairman of the Board of Bayerische Flugzeugwerke AG and Works Manager of the Augsburg plant, allegedly for representing his own interests, and his activities were restricted to those of Chief Designer.¹⁰³ Relations between the Messerschmitt-Werke and the Luftwaffe Command remained strained. Asked about the issue on 26 May 1944, Field Marshal Milch responded with his standard threat: 'If you want to clear this up, you will have to throw the whole Messerschmitt company into a concentration camp . . .'.¹⁰⁴

After the outbreak of the war the air-armament industry had apparently recognised, despite all efforts to maintain some independence, the need for reasonable planning and control of the limited resources. Production had to accommodate changing priorities, development and production orders by the Reich Aviation Ministry, and the countless requests for design changes. All this had to be brought into line with steel and aluminium quotas, tight control of the labour force and other raw materials, cost control, established man-hours for production, and unit

prices – and with all the bureaucratic red tape. This system was not very flexible and became uneconomic whenever production targets and hasty changes were not tuned to the actual production capacities, for instance when the Luftwaffe initiated a 'production plan' in the summer of 1943 and did not discover until late 1943 that the required quantity of aluminium could not be provided.¹⁰⁵ Shortcomings in the co-ordination of plans and a frequent lack of continuity in the issue of production orders resulted in the uneconomic operation of plants, caused a fall-off in production, and led to high expenditure to return plants to full production.¹⁰⁶

The spanners in the works of this system of partial plans and deputies and special deputies, and the resulting disappointments gave rise to distrust, scepticism and resistance in firms. They developed strategies to deal with this. Demands were answered with counterdemands. Air armament had become the industrial sector with the greatest labour force. In 1944, 48.5 per cent of all employees working in the plants and supervised by the military were employed in air armament (as opposed to some 32 per cent on 31 January 1941):

Employees of the major aircraft manufacturers in 1944/45
(Pohlmann 1982)

Junkers	165,000
Messerschmitt	81,000
Heinkel	49,800
Dornier	22,100
Focke-Wulf	4,000

Wartime production at that time was characterised by chaotic improvisation. Frequently, not much was done to stop production getting out of control, and instead it was left to the plant representatives of the Fighter Board to increase production output, to avoid being blamed for the situation. In the Fighter Board, the deputy for aircraft engines, Lange, took an unrealistic position in view of the general demoralisation. 'I wish to support what Saur said, and demand and demand again. Industry is willing and just waiting for it.'¹⁰⁷ During an inspection tour by the Fighter Board at the Messerschmitt plant in Regensburg, Milch, on the other hand, switched to pleading: 'I want to ask the Messerschmitt company once again very urgently, please, do not raise higher demands than necessary. You have a reputation for making excessive demands, because you argue: well, we will only get so and so many per cent . . .'

The process of limiting and curtailing industry's freedom of action began in 1933 and successively removed more and more areas of the decision-making process from industry. To buffer bad feelings and prevent difficulties, Luftwaffe officers were seconded to the management of the larger firms as early as late 1934 as industrial advisers.¹⁰⁸ Acceptance-inspection officers had been a familiar sight in aircraft plants for a long time. But the Fighter Board was no longer satisfied with just having Luftwaffe officers in the aircraft plants to supervise production. It appointed a representative in each plant from the staff and, in addition, expected company representatives to act as intermediaries between the company and the Fighter Board. The less companies met the requirements of the Luftwaffe Command or, towards the end of the war, of Speer's ministry and the Fighter Board, and the less they satisfied military and ministerial ideas of performance of duty, the more these bodies interfered in the firms' staff policies and, if they felt the need, replaced entire managements. Ernst Heinkel lost the responsibility for the success or failure of the development of the He 177 long-range bomber, which has been the subject of much discussion in publications, when in September 1942 the Reich Aviation Ministry transferred the engineer, Baade, for two years from Junkers to the Heinkel company to take over direction of the company's development work, primarily on the He 177.¹⁰⁹

After 1941, Ernst Heinkel devoted himself more and more to the last task he retained as a manager – business administration. He had successfully negotiated with the Reich on the price of the Heinkel plant – the production facility for the controversial He 177 – and obtained a favourable deal for its sale to the Reich. Out of consideration for the insurance companies which granted loans, he gave up personal ownership and converted his company back to a limited-liability status, effective on 1 April 1941, with capital stocks of 20 million marks.¹¹⁰ The structure of the balance sheet of the Heinkel GmbH (balance-sheet total in 1941: about 217 million marks; in 1942: 266.2 million) can be assumed to have been similar to that of the other contemporary aircraft producers. Until 1942 its assets side was characterised by high payments on account received from customers, primarily the Reich Aviation Ministry, on current production series and for other services, 79.1 million marks in 1941 and 109.5 million in 1942. On the liabilities side, there were substantial debts to loan companies and the discounts granted to the Aviation Ministry

(an amount of 13.8 million marks in 1941); but the profits of the firm were not noticeably affected.

In 1943 the Reich Aviation Ministry forced all Heinkel plants to merge into a joint-stock company, with basic capital stocks of 50 million marks.¹¹¹ The structure of the balance sheets of air-armament firms changed again, because the previous high advances and partial payments by the government to fund military procurement orders had been discontinued as of 1 October 1942. This meant that funding of the aeronautical industry was solely its own responsibility, forcing it to take out working capital loans, debentures and syndicated funds, and making it a large debtor to banks and insurance companies toward the end of the war.¹¹² The merger of the Heinkel plants created a single firm, which reached its highest number of employees on 31 March 1944 with 49,839,¹¹³ had an annual turnover of over 500 million marks (a per caput turnover of about 10,000 marks) and had the remarkable profit-rate of 1.6–1.7 per cent of the turnover. Ernst Heinkel, however, was no longer on the Board of Directors of the Ernst Heinkel AG, but had had to hand over chairmanship to Carl Frydag and had been pushed out to the post of Chairman of the Board of Supervisors.

The always somewhat undefined borderline between private enterprise and state-run economy in the air-armament industry had shifted further towards state intervention and a military command economy during the war. In reality the industry was government-controlled, and the directions it was given were much like military orders. Non-compliance could well have consequences for the physical well-being of its representatives. Enforcement of production was helped by special rations of cigarettes and liquor, together with the threat of force. 'We should be aware', said Field Marshal Milch on 10 March in Regensburg, 'if we think about it as my friend Saur does, what Stalin would do in that situation in Russia' – then everybody who failed to do his job would have to be shot.¹¹⁴

There is abundant proof that the political and military leadership rigorously claimed and exercised primacy in controlling the military-industrial complex and, therefore, also installed managers in industry who were fully obedient to the Luftwaffe Command and Speer's Ministry. The placing under guardianship and ousting of the private managers of the air-armament industry involved Willy Messerschmitt, Ernst Heinkel, Gerhard Fieseler and Hanns Klemm. Coercion was exercised against

well-known designers (Tank and others) and plant directors.

Gerhard Fieseler, of Kassel, was regarded as an unacceptable manager by Milch, who replaced him initially with a commissar as plant director. In March 1944, however, Fieseler spoke out before the Fighter Board: 'I have been sick for two years, because I have seen what situation the aeronautical industry is in . . . I was sick and only six weeks ago had I recovered so far that I was able to work again. Ever since, I have been standing at the factory gate in the morning to welcome those workers arriving late.'¹¹⁵ In late 1944 the Reich Minister for Armament and Wartime Production forced the management of Blohm and Voss to relieve the long-time production chief Max P. Andreae of his post and put the entire aircraft production in the hands of a 'commissioner', who had worked in the company only since September 1944.¹¹⁶ When aircraft producer Hanns Klemm, in March 1943, refused to convert his entire production to construction of the Me 163, he managed to beat the armament representatives and the Industrial Council, busily working at removing him from management, by resigning as plant director and leaving the firm, and by announcing his resignation as a party member. However, until the war ended he had to go through a horrible odyssey as a victim of the Gestapo. When the newly installed management proved unable to solve the production problems related to the Me 163,¹¹⁷ the whole Klemm firm was impounded by the Reich Aviation Minister, with the agreement of the Reich Ministry for Armament and War Production, and placed under the administration of a Reich commissar. Despite government intervention, the destruction of the war and periods of idleness, however, aircraft and aircraft-engine producers did not enter red figures on their balance sheets until 1943, and in some cases until 1944.¹¹⁸

Notes

1. Cf. Ernst Heinkel, *Stürmisches Leben*, 5th edn, ed. Jürgen Thorwald, Preetz, 1963, p. 137 f.
2. Zentrales Staatsarchiv der DDR, Potsdam, Reichsrechnungshof.
3. In this context, particular notice should be taken of the aircraft factories of Udet and Fieseler.
4. Heinkel, *Leben*, p. 281.

5. Hermann Pohlmann, *Chronik eines Flugzeugwerkes 1932-1945*. Blohm & Voss, Hamburger Flugzeugbau GmbH, 2nd edn, Stuttgart, 1982, p. 57.
6. Günter Schmitt, *Hugo Junkers und seine Flugzeuge*, Stuttgart 1986, p. 56.
7. *Ibid.*, p. 66.
8. Claude Dornier, *Aus meiner Ingenieurlaufbahn*, Zug, 1966, p. 174.
9. Willi A. Boelcke, 'Friedrichshafens industrieller Aufstieg', *Zeitschrift für württembergische Landesgeschichte*, 47 Jg., 1988, pp. 457-94, p. 478 f.
10. Lutz Tittel, *100 Jahre Claude Dornier. Metallflugzeugbau 1914-1969*. Friedrichshafen, 1984, pp. 30-34.
11. *Ibid.*, p. 74.
12. Bundesarchiv/Militärarchiv, RH 8v. 359. (survey forms); H. Dieter Köhler, *Ernst Heinkel - Pionier der Schnellflugzeuge, Eine Biographie*, Koblenz, 1983, pp. 60-63 on the HE 5 and HD 24 (E-monoplane, D-biplane), of which 15 aircraft were built. In 1928, Heinkel developed the HD 37 single-seat fighter from the HD 36 (trainer) with 100,000 Marks of Reichswehr funds. Further developments led to the He 45, a warplane produced in large numbers for the Luftwaffe (p. 97 f).
13. Heinkel, *Leben*, 1963, p. 282; Köhler, *Heinkel*, 1983, p. 217.
14. Heinz J. Nowarra, *Die deutsche Luftrüstung 1933-1945*, Vol. 1: 'Flugzeugtypen AEG-Dornier', Koblenz, 1985, p. 38. Survey form, note 12. F 31 SD I was the forerunner of the Arado 64.
15. Nowarra, *Die deutsche Luftrüstung 1933-1945*, Vol. 2, Koblenz, 1986, p. 51.
16. Rolf Italiaander, *Wegbereiter deutscher Luftgeltung. Neun Lebensbilder*, Berlin, 1941, p. 228.
17. *Ibid.*, p. 228-9; Survey form, note 12.
18. David Irving, *Die Tragödie der Deutschen Luftwaffe. Aus den Akten und Erinnerungen von Feldmarschall Milch*, Frankfurt/M.-Berlin-Vienna, 1970, p. 68.
19. Nowarra, *Luftrüstung*, Bd. 1, p. 36; Survey form, note 12. Also liquidated were the Bäumer Aero, Hamburg; Mehr-Werk, Friedrichshafen; AGO-Flugzeugwerke, Oschersleben; Sablanig; Hansa-Brandenburg; Aero-Sport.
20. Schmitt, *Junkers*, p. 213.
21. Peter Supf, *Hans Klemm. Der Schöpfer des Leichtflugzeugs*, Stuttgart, 1955, pp. 31, 36 f.
22. *Ibid.*, p. 60, 63 f.
23. Italiaander, *Wegbereiter*, p. 111 f; Nowarra, *Luftrüstung*, Bd. 2, p. 24.
24. Heinkel, *Leben*, p. 142 f.
25. Nowarra, *Luftrüstung*, Bd. 2, pp. 159-75.
26. Catapult tests at Warnemünde were funded from the secret Navy budget.
27. Nowarra, *Luftrüstung*, Bd. 2, pp. 178 f; Heinkel, *Leben*, pp. 228 f and 236 f.
28. Cf. Heinkel, *Leben*, p. 204.
29. 1928: 1,260,000 RM.
30. Schmitt, *Junkers*, p. 56; Ernst Willi Hansen, *Reichswehr und Industrie. Rüstungswirtschaftliche Zusammenarbeit und wirtschaftliche Mobilisierungsvorbereitungen 1923-1932*, Boppard am Rhein, 1978, p. 141.
31. Militärgeschichtliches Forschungsamt (ed.), *Handbuch zur deutschen Militärgeschichte 1648-1939*, Vol. 4, Munich, 1978, p. 524 f.
32. Cf. Heinkel, *Leben*, p. 278.
33. Irving, *Tragödie*, p. 51.
34. Professor Hugo Junkers was a member of the German Democratic Party.

35. Schmitt, *Junkers*, p. 214 f.
36. Irving, *Tragödie*, p. 76 f.
37. Schmitt, *Junkers*, p. 218.
38. Lutz Graf Schwerin von Krosigk, *Die große Zeit des Feuers. Der Weg der deutschen Industrie*, Vol. 3, Tübingen, 1959, p. 64.
39. Nowarra, *Luftrüstung*, Bd. 2, p. 42 f.
40. Nowarra, *Luftrüstung*, Bd. 1, p. 149 f.; Bundesarchiv/Militärarchiv Freiburg, RL 3 Nr. 326.
41. Supf, *Klemm*, p. 82 f.
42. *Ibid.*, p. 86 f.
43. Tittel, *100 Jahre*, pp. 109, 111; Nowarra, *Luftrüstung*, Bd. 1, pp. 174, 195 f.; Bundesarchiv/Militärarchiv RL 3 Nr. 359 u. 360.
44. Nowarra, *Luftrüstung*, Bd. 1, p. 181.
45. Political Archive of the German Ministry of Foreign Affairs, Bonn.
46. Heinkel, *Leben*, pp. 286-93; Irving, *Tragödie*, p. 78.
47. Heinkel, *Leben*, p. 280; Irving, *Tragödie*, p. 68.
48. Heinkel-Archiv, Stuttgart.
49. Karl-Heinz Völker, *Die deutsche Luftwaffe 1933-1939. Aufbau, Führung und Rüstung der Luftwaffe sowie die Entwicklung der deutschen Luftkriegstheorie*, Stuttgart, 1967, pp. 56-8; Köhler, Heinkel, pp. 97-102; Nowarra, *Luftrüstung*, Bd. 2, pp. 39 f., and others.
50. Völker, *Luftwaffe*, p. 59.
51. Bundesarchiv/Militärarchiv Freiburg RL3 Nr. 325.
52. Köhler, Heinkel, p. 219.
53. Heinkel, *Leben*, p. 313. The number of employees in the German aeronautical industry increased from mid-1933 to mid-1935 from 6,970 to 72,000.
54. Georg Thomas, *Geschichte der deutschen Wehr- und Rüstungswirtschaft (1918-1943/45)*, ed. W. Birkenfeld, Boppard a. Rh., 1966, p. 87; Willi A. Boelcke, *Die Kosten von Hitlers Krieg. Kriegsfinanzierung und finanzielles Kriegserbe in Deutschland 1933-1948*, Paderborn, 1985, p. 40 f.
55. After Köhler, Heinkel, p. 217; Heinkel, *Leben*, p. 315.
56. Heinkel, *Leben*, p. 278 f.; Pohlmann, *Chronik*, p. 203.
57. On the Erla, controlled by DKW and previously at Friedrichshafen: Nowarra, *Luftrüstung*, Bd. 2, p. 17.
58. On Gotha: Nowarra, *Luftrüstung*, Bd. 2, pp. 130-55.
59. Horst Lange, *REIMAHG - Unternehmen des Todes*, Jena, 1969, p. 42; Nowarra, *Luftrüstung*, Bd. 1, p. 32.
60. Nowarra, *Luftrüstung*, Bd. 1, p. 31.
61. *Ibid.*, p. 90.
62. Pohlmann, *Chronik*, p. 204.
63. Bundesarchiv Koblenz, R2/5551.
64. Boelcke, *Kosten von Hitlers Krieg*, p. 45 f.
65. Völker, *Luftwaffe*, p. 136.
66. Pohlmann, *Chronik*, p. 63.
67. For examples of actual workloads, see Pohlmann, *Chronik*, p. 205, and others.
68. Bundesarchiv/Militärarchiv Freiburg, RL 3 Nr. 289.
69. On the confrontation of Schacht and Goering, cf. Willi A. Boelcke, *Die*

- deutsche Wirtschaft 1930–1945. Interna des Reichwirtschaftsministeriums, Düsseldorf, 1983, pp. 167 ff.
70. Bundesarchiv/Militärarchiv Freiburg, RL3 Nr. 331.
71. Ibid.
72. Pohlmann, *Chronik*, pp. 213–15.
73. Polit. Archiv des Auswärtigen Amtes, Bonn; Heinkel-Archiv, Stuttgart.
74. Bundesarchiv/Militärarchiv, RL3 Nr. 315.
75. Ibid.
76. Production index in Völker, *Luftwaffe*, p. 131.
77. Boelcke, *Kosten von Hitlers Krieg*, pp. 22, 28.
78. Ibid., p. 28; Völker, *Luftwaffe*, p. 131.
79. Völker, *Luftwaffe*, p. 188 f.; cf. Richard J. Overy, *Hermann Göring. Machtgier und Eitelkeit*, Munich, 1986, p. 286 f.
80. Völker, *Luftwaffe*, p. 132 f.; Heinkel, *Leben*, pp. 434, 437; Manfred Barthel and Gerold Lingnau, *100 Jahre Daimler-Benz. Die Technik*, Mainz, 1986, pp. 122 ff.; Kyrill von Gersdorff and Kurt Grasmann, *Flugmotoren und Strahltriebwerke*, Munich, 1981, pp. 111, 179–83.
81. Heinkel-Archiv, Stuttgart.
82. Bundesarchiv/Militärarchiv, RL3 Nr. 352; Heinkel, *Leben*, p. 420 f.
83. Nowarra, *Luftrüstung*, Bd. 2, p. 98 f.
84. Nowarra, *Luftrüstung*, Bd. 1, p. 212.
85. Cf. Irving, *Tragödie*, pp. 184–7; Overy, *Air War*, pp. 300 ff.
86. Irving, *Tragödie*, p. 139 f., p. 143; Alan S. Milward, *Die deutsche Kriegswirtschaft 1939–1945*, Stuttgart, 1966, p. 37; Bundesarchiv/Militärarchiv Freiburg RL3 Nr. 552.
87. Statistics in Werner Baumbach, *Zu spät?*, Munich, 1949, p. 62, should be corrected by Speer Statistics in Willi A. Boelcke (ed.), *Deutschlands Rüstung im Zweiten Weltkrieg. Hitlers Konferenzen mit Albert Speer*, Frankfurt a. Main, 1969, p. 25. Total number of warplanes (from 1941, incl. gliders and sail planes): 1939: 2,518; 1940: 10,247; 1941: 12,324; 1942: 15,456; 1943: 25,668; 1944: 38,122.
88. Cf. Pohlmann, *Chronik*, p. 210 f.
89. Bundesarchiv/Militärarchiv Freiburg, RL3 Nr. 558, 561, 562, 563, 565.
90. Heinkel, *Leben*, p. 424; Irving, *Tragödie*, pp. 183–7.
91. Irving, *Tragödie*, p. 183; Boelcke, *Rüstung*, p. 215; Overy, *Göring*, p. 307.
92. Overy, *Göring*, pp. 313 ff.; Boelcke, *Kosten von Hitlers Krieg*, p. 126; and sources in note 87 above.
93. Dietrich Eichholtz, *Geschichte der deutschen Kriegswirtschaft 1939–1945*, Vol. II: 1941–1943, Berlin-Ost, 1985, p. 12; Overy, *Göring*, pp. 321 ff. In November 1941, the Chairmanship was transferred to Undersecretary of State for Air Milch; before this, in early October, Dr Westrick of the Vereinigte Aluminiumwerke was appointed to replace Koppenberg. Newly appointed were Dr Vogler of the Vereinigte Stahlwerke and Admiral Lahs as chief of the aeronautics group.
94. Eichholtz, *Geschichte*, p. 13 f.; Irving, *Tragödie*, p. 189 f.
95. Statistics in Boelcke, *Rüstung*, p. 25; Eichholtz, *Geschichte*, p. 33.
96. Pohlmann, *Chronik*, p. 86.
97. Hans-Joachim Weyres von Levetzow, 'Die deutsche Rüstungswirtschaft von 1942 bis zum Ende des Krieges', *Rer. pol. Diss.*, Munich, 1975, p. 22 f.;

- Overy, *Göring*, p. 323.
98. Nachrichten des Reichsministers für Bewaffnung und Munition Nr. 28 (1943), p. 300.
99. Ibid., Nr. 24 (1943), p. 17 f.; as of 10 April 1942.
100. The following goods were being built: Ju 52, Ju 87, Ju 88; Me 108, Me 109, Me 110, Me 211, He 111, He 177; FW 189, FW 190, FW 200; Ar 96, Ar 196; Si 204; Hs 129, 293; BV 138; Bü 131, Bü 133, Bü 181; Fi 156; Kl 35.
101. Nowarra, *Luftrüstung*, Bd. 2, p. 72 f.; Irving, *Tragödie*, p. 201 f.
102. Heinkel, *Leben*, p. 494; Overy, *Göring*, pp. 324-8.
103. Cf. Heinkel, *Leben*, p. 494; Overy, *Göring*, p. 320; Gerhard Hetzer, 'Unternehmer und leitende Angestellte zwischen Rüstungseinsatz und politischer Säuberung, in *Von Stalingrad zur Währungsreform. Zur Sozialgeschichte des Umbruchs in Deutschland*, ed. Martin Broszat et al., Munich, 1988, p. 567 f.
104. Bundesarchiv/Militärarchiv Freiburg, RL 3/1.
105. Erich Welter, *Falsch und richtig planen. Eine kritische Studie über die deutsche Wirtschaftslenkung im Zweiten Weltkrieg*, Heidelberg, 1954, p. 28 f.
106. Welter, *Falsch und richtig*, p. 30 f.
107. Bundesarchiv/Militärarchiv Freiburg, RL 3/1.
108. Völker, *Luftwaffe*, p. 59 f.
109. Heinkel-Archiv, Stuttgart; Irving, *Tragödie*, p. 242, on the problems with the DB 606 and 610 engine cf. von Gersdorff and Grasmann, *Flugmotoren*, p. 111.
110. Annual reports, Heinkel-Archiv, Stuttgart.
111. Adjustments of capital stocks were also made by other aircraft producers; Arado effected an increase from 20 million to 50 million marks.
112. Weyres von Levetzow, 'Rüstungswirtschaft', p. 197; Köhler, *Heinkel*, p. 218; Boelcke, *Kosten von Hitlers Krieg*, p. 129 f.; Geschäftsberichte im Heinkel-Archiv, Stuttgart.
113. Heinkel-Archiv, Stuttgart.
114. Bundesarchiv/Militärarchiv Freiburg, RL 3/1.
115. Ibid.
116. Pohlmann, *Chronik*, p. 65.
117. Supf, *Klemm*, p. 110-13.
118. The Daimler-Benz Company operated at a profit until 1943. Hans Pohl, Stephanie Habeth and Beate Brüninghaus, *Die Daimler-Benz AG in den Jahren 1933 bis 1945*, Wiesbaden, 1986, p. 132 f.

4

Air Army and Aircraft Industry in Italy, 1936–1943

Lucio Ceva and Andrea Curami

Section 1: The Illusory Prestige of the Regia Aeronautica

Before Italy's entry into the war (10 June 1940) the Regia Aeronautica (hereinafter called RA) enjoyed a certain amount of prestige not only among the public but also, partially, among air forces of countries destined to become either allies or enemies. The reason for this can be summarised as follows:

1. Italy was one of the first countries to have established aviation as an independent force (1923).
2. Some Italian pilots, as early as the 1920s, had engaged in noteworthy aviation exploits. Furthermore, under the direction of Italo Balbo, Italian aviation, between 1926 and 1933, had carried out long-distance flights across the Mediterranean and the Black Sea, and had made Atlantic crossings using a significant number of aircraft and pilots.
3. Men and machines belonging to the RA had garnered numerous records, which included sea-plane speed (1934) and altitude (1939) records.
4. The RA was the air force that played the most important military role in the years before the Second World War, its operations in Libya (until 1932) and Ethiopia 1935–6 having been the most important of all the operations that were carried out in colonies, including those of the RAF and the Armée de l'Air. During the Spanish War (1936–9), the Italian participation was larger than that of the Luftwaffe. In fact,

Section 1 has been written by Lucio Ceva, Sections 2 and 3 by Andrea Curami.

these Italian victories have not always been accorded the necessary critical appraisal.

5. The Italian General Giulio Douhet (1869-1930) was the first person to put forward the idea of using aviation as an independent and decisive weapon. Additionally he had publicly proclaimed the need for a single military vertex with the power to co-ordinate the use of the three Armed Forces. Douhet's theories were also known because of the points Italy had in common with those devised by other foreign experts, such as Mitchell and Seversky.

Yet despite the good results of single pilots and crews, the facts belie the technical and collective efficiency of the RA.

Today, at least in Italy, studies carried out have brought to light the varying examples of deception implicit in each of the five propositions (1-5) listed in the previous paragraph.

These are known ideas that will be dealt with only briefly here, both on account of a lack of time and because of other French and English texts that have already dealt with this subject on an international scientific level.¹ More complex and less widely studied are a series of circumstances largely attributable to the Italian Aeronautical Industry, one of the many elements responsible for Italian military failure. The second and third sections of this chapter are devoted to these aspects.

Here then is a summary of the circumstances that we assume to be already known, as well as some other considerations, of a more general nature, that are linked to the detailed developments of the two technical sections, covering not only the industrial aspects but also the strict relationship that these have with organisational and training problems, as well as with the tactical solutions later implemented during the conflict.

The independence of the RA is manifested in its total autonomy *vis-à-vis* the Army and Navy. The decree of 1925, made by the Undersecretary of Air General Bonzani, stated that, of the 182 squadrons constituting the Aerial Army strength, 78, already pre-determined, should be put at the disposition of the Army, while another 35 would be made available to the Navy. The Navy and Army Air Forces were reduced to a very few reconnaissance squadrons, though the possibility of the RA's assisting in these operations was also taken into consideration. Subsequently, in 1931, and after a long struggle, the Minister of Air, Balbo, managed to ensure that RA contributions to land and sea operations would no longer consist of a fixed number of

squadrons, but of units to be decided on, following direct agreements, each time. The total independence of the RA was not justified by the drawing up of a specific doctrine of use. Despite Douhet's being proclaimed the official expert of the RA after his death in 1930, it is obvious that his name and the international glamour surrounding him were used to cover up the non-existence of a doctrine. All that need be remembered is that the main theme of the Douhetian concepts was the availability of strongly armed and armoured combat planes, whose task was to clear the sky of enemy planes, plus other planes with a capacity of '6000 horsepower, strongly armed and strongly armoured and with ranges capable of allowing them to cross oceans, each carrying a large enough load of bombs to destroy a city'.²

But not even an attempt, at that time in Italy, was made to manufacture an aircraft in line with 'Douhetian' characteristics. In 1933 five different prototypes of large planes were grouped into an experimental squadron, but these had such diverse characteristics that they were never able to operate together, and none of them even came close to the characteristics indicated by Douhet.

However, in aircraft manufacturing some notice was taken of the ideas of another Italian military expert, Colonel Amedeo Mecozzi, who upheld the importance of only 'assalto' (assault) planes (i.e. planes that, as well as being designed to defend themselves independently against enemy fighters, could also attack targets on the ground with small bombs and guns). But at the end of the 1920s and the beginning of the 1930s no more than a few hundred rather unsuccessful so-called 'Mecozzian' prototypes were constructed.

The RA presented itself at the beginning of the Second World War with a few hundred 'medium' bombers, with speeds ranging from 400 to 460 km/h, each armed with three or four machine guns and incapable of crossing any ocean (ranges were included between 1795 and 1825 km, with a bomb-load between 900 and 1,000 kg). The fighter squadrons, primarily based on biplanes with good aerobatic characteristics but poor speed and equipment, were in the process of changing to the new monoplane models with a retractable landing gear.³ But these new types of aircraft, besides being inferior to those of potential enemies, also had numerous technical defects that not even the most skilled pilots could remedy.

The causes of the technical inferiority of Italian aircraft compared with those of their adversaries and allies are numerous.

Some of these will subsequently be examined in Sections 2 and 3, with particular reference to engine and airframe problems. In this section we should like to concentrate on problems of a more general and political nature that had important results at the technical-industrial level.

Italo Balbo was Minister of Air from 12 September 1926 to 6 November 1933. Only recently has research been carried out on him, and opinions about his actions are rather varied.⁴ None the less, as yet historians have not considered the real influence of some of the reforms proposed by Balbo in his speech to the Chamber of Deputies on 29 March 1927. Among Balbo's numerous requests, all of which were accepted, becoming either law and/or regulations, there is one referring to the *Direzione Generale del Genio e delle Costruzioni Aeronautiche* (DGCA – General Directing Office of Engineers and Aeronautical Construction), i.e. the only technical office of the Ministry that dealt with the specifications of new aircraft, including the testing and choice of prototypes and orders to the factories. Using seemingly reasonable arguments ('the evaluation of material will not include those who are destined to use it', i.e. the pilots) Balbo gave the old *Direzione Generale del Genio e delle Costruzioni Aeronautiche* (renamed, for the occasion, *Direzione Superiore Studi Esperienze* – DSSE, High Directing Office of Studies and Tests) exclusively scientific-experimental tasks, relating, above all, to aerodynamic researches relative to aircraft and related accessories, so that they had no power in terms of the choice of aircraft or orders for industry. The latter powers, whose importance does not call for any comment, became an exclusive prerogative of other offices and, above all, of the *Direzione Generale Costruzioni e Approvvigionamenti* (OGCA, General Directing Office of Aeronautical Construction and Supplies) from which technicians were strictly excluded.

Now, this seclusion of technicians in an office of an exclusively scientific-experimental nature was not without consequence. The technicians belonging to the *Genio Aeronautico* (Aeronautic Engineers) continued to express their opinions about either the quality or defects of the new prototypes, with accurate conclusions. But the choice depended exclusively on the men in the DGCA most favoured by the minister in office. There are many examples of how this latter office, ignoring the opinion of the DSSE, ordered the mass construction of prototypes that the technicians, in written reports, had found to be absolutely inferior to others.

A particularly serious and significant example, in terms of the imminence of the Second World War and the consequences that this decision had on the quality of Italian fighters, took place during the competition of 1938. The DSSE had said that the aircraft of the Caproni Group (RE 2000, F5, and Ca 165, i.e. two monoplanes and one biplane) were superior, but this opinion was not taken into consideration by the Undersecretary of Air (General Giuseppe Valle, who succeeded Balbo and did not change the internal organisation of the RA in any way), who had chosen the inferior MC 200 monoplanes (Macchi Castoldi) and the mediocre G 50 Fiat, as well as the Fiat CR 42 biplanes. There may be many different opinions regarding this ministerial choice. Two points, however, cannot be overlooked: the MC 200 and the two Fiats (G 50 and CR 42) were amongst the most outdated fighter planes used by the fighting powers; the report made by the Genio Aeronautico on 3 September 1939, stemming from the fighter competition of 1938, had, as has already been said, stated that other aircraft were superior.⁵

A single supreme command of the Armed Forces as proposed by Douhet was only apparent in Italy. It might perhaps have deceived some foreigners, like the editor of the authoritative *Revue d'Études Militaires*, who, in 1930, defined the Italian system as 'triceps', because there were three military ministries, co-ordinated, however, by 'il Duce', supported by the Chief of the Stato Maggiore Generale (Supreme General Staff).⁶

The fact is that anyone who had studied the situation in Italy, even had they done no more than merely consider the simple provisions of the law in force (above all RDL - Regio Decreto Legge- of 6 February 1927, no. 68), would have realised that the Chief of the Stato Maggiore Generale did not have the powers to co-ordinate the action of Ministers of the three Armed Forces. In reality, Mussolini was almost always Minister of all the three Armed Forces, whose daily running was entrusted to undersecretaries (as well as to Chiefs of the Stato Maggiore or General Staff) who negotiated separately with him, and who were changed on an average of every three years. Only the Chief of the Stato Maggiore Generale (Marshal Pietro Badoglio) remained in power for as long as fifteen years (1925-40), having no concrete powers because he was only able to communicate with the individual Chiefs of the Armed Forces through Mussolini. This is obviously not the right place to discuss the political reasons that induced 'il Duce' to adopt such an irrational system. Here, all that is needed is to draw a most obvious conclu-

sion of a military nature: each of the Armed Forces prepared its own war, and was organised and armed only on the basis of political indications, given separately and from time to time by 'il Duce' to each Chief of the Stato Maggiore. There was, therefore, absolutely no trace of the 'Douhetian' unity of control.

As for the policy of records as well as that of important long-distance flights, it is by now well known that this policy did not always have favourable consequences. In fact, two categories of pilots were formed: one category who had to execute the more difficult and conspicuous tasks, and another, larger, one consisting of less expert pilots – a category for which suitable training was not considered necessary.

Participation in colonial operations served at most to heighten the abilities of some professional groups in certain fields of navigation, of which the desert type is an example.

The Spanish War could have been a valuable experience. But the result was negligible. This was mainly for two reasons. The Stato Maggiore did not realise that some of the success achieved with aerobatic biplanes was, above all, attributable to the deficiencies of enemy pilots who were not always capable of handling competently their more modern, better-armed monoplanes. Furthermore, the presence of a small but aggressive group of German fighter pilots ended up by changing the terms of the confrontation. With regard to bombing, the incursions effected by a small number of aircraft over practically defenceless cities did not have much to teach.⁷

Let us now discuss some points regarding Italian industry as a whole (and consequently, indirectly, the aeronautic industry as well) during the second half of the twenty years of Fascism, i.e. commencing with the start of the 1930s.

The consequences of the American recession of 1929 began to manifest themselves immediately in the years following, peaking in 1932. This forced many industries into cartel agreements, partly subsidised by the state and later even becoming obligatory (such as the organisation of the iron and steel industries provided for by the RDL of 31 December 1931 no. 1670). On the other hand, in other cases similar agreements were of a clandestine nature, violating the penal laws governing military supplies.

In this way a monopolistic policy was put into practice, both *vis-à-vis* other countries by a customs barrier and also by an internal market divided up according to pre-fixed quotations with prices suited to costs (in short, the 'marginal' producer or

the one with the largest expenses was taken into account).

Furthermore, one of the consequences of the direct taking over of many industries by the state, after the financial crisis of 1929-33, was the gradual extension of state control of all economic activities, including those still privately owned. By means of a series of laws (such as those of 12 January 1933 no. 141 and the RDL 14 January 1933 no. 848) the creation of new industrial plants as well as the enlargement of existing ones was subjected to a regime of authorisations that depended on official bodies into which private industry had made sure, however, of putting its own men.

Industrial organisations that had, on principle, refused this type of state regulation, ended up by realising that the above-mentioned bodies might come in handy. In order to prevent the birth or development of competitive industries, a good system – that of making a certain number of applications for the creation of new plants – was employed. These applications, although accepted, did not result, at least in the majority of cases, in the effective foundation of such plants, but often played a decisive role in repelling, as useless 'duplicates', the applications that real potential competitors might have presented in the same field. Naturally, the structures of authority could be corrupted. For example, returning to obligatory consortia, it happened, at times, that the elimination of competition and price stability encouraged new initiatives of a purely blackmailing nature, i.e. those springing from the desire to be absorbed into the consortia in order to obtain significant benefits.

On a more general level, it is necessary to recognise that all this led to the consolidation of positions of profit and monopoly. Furthermore, externally the breaking away of the Italian industrial economy from the international economy was emphasised. It is evident that this state of affairs was anything but beneficial to the initiative, promptness and development of studies necessary for good results in the shape of any inventiveness in the industrial field, and particularly in the aeronautical sector.⁸

Not only did the Italian dictator give sporadic, contradictory indications regarding his policy to the heads of the Armed Forces (as mentioned above); he also made speeches in public, and in special meetings discussed programmes and orientations that would have been impossible to translate into coherent directives of either an industrial or a military nature.

The words which Mussolini addressed to the Chief of the *Stato Maggiore Generale* and to the Chiefs of the *Stato Maggiore*

of the three Armed Forces that we are going to quote here, are taken from the minutes of the meeting held on 18 July 1927:

As far as he [Mussolini] is concerned, he regards this meeting as the first one held for a systematic preparation of war. This preparation has two sides, a political one and a military one. The political aspect refers both to the domestic and foreign situation. The former can be considered a sound situation and our country could resist a war. As far as the latter is concerned, both obvious and less obvious wheeps have been set in motion in order to allow us to play our game.

From a military point of view, in the event of war it is to prepare and co-ordinate the action of all armed forces. Today, 18 July, marks the beginning of a systematic preparation for war.

War may or may not be far off, but it is likely to break out. [. . .]

The Prime Minister summarises his considerations by pointing out that the following must be studied: [. . .]

(d) The war offensive plan. He insists on saying offensive because he states that the quicker the offensive action the more probable it is that war will be won.

In the event of this failing to occur, the Danube enemy would probably not desist from its waiting posture. While this hold up in military operations would encourage nations interested in creating complications and difficulties. Attack must be aggressive, sudden [original underlining].

The war plans against Yugoslavia and France 'were heavily reliant on the Air Force and therefore on the Navy'.

It must in fact, be expected that the first act of aggression, together with the declaration of war (or perhaps in substitution of this formality), would be the invasion of our skies by enemy air squadrons [. . .]. For this reason defensive cover must above all be aimed at avoiding this invasion by exerting an extremely active defence against them; in other words the goal must be the cutting off of the enemy air attack right there while it is still cringing within the perimeter of their bases. This means anticipating the enemy by bombing his airfields when they are all quiet and their planes are still waiting to take off.⁹

These bellicose aeronautical programmes had to co-exist with Mussolini's declaration to the Chamber of Deputies made on the previous 26 May. This speech was known as the 'Ascension day speech': 'There is a type of urbanism that is destructive, that makes people sterile - this is industrial urbanism [. . .]. This explains why I help agriculture, why I say that I am rural . . .

this will explain why I will only allow the healthy industries in Italy to work either in agriculture or on the sea.¹⁰

The industries connected with agriculture were not only those producing manure and fertilisers but also those producing equipment for agricultural mechanisation, for milling industries and for bread-making factories, for food-packing industries and for the transportation of agricultural products. Industries linked to the sea could include shipyards, with particular emphasis on fishing fleets, and, yet again, food-packing and transportation plants.

It is difficult to understand how such a programme was thought to be compatible with aggressive action against large industrial powers, or even with that imminent offensive which, some days later, Mussolini discussed with the most important leaders of the country.

On the other hand, it would be a mistake to believe that these contradictions between public speeches and secret meetings held by Mussolini with the military heads were the fruit of cunning and deceit. In reality, no less serious contradictions are also found in documents of a secret nature. Thus, for example, in a meeting held on 2 December 1937 between Badoglio and the undersecretaries (heads of SM) of the three Armed Forces (Generals Pariani and Valle and Admiral Cavagnari), on the initiative of Pariani it was decided to prepare for an attack on Egypt. As many as fourteen months were needed to devise two plans: one an agreement between the Air Force and the Army (a rare case of collaboration), and the other prepared by the Navy. In the next meeting, held on 26 January 1939, the plans of the Navy and Army-Air Force were not discussed, because Badoglio immediately declared that the head of the government had assured him that, while it was possible to count on Yugoslavia's friendship, the only danger of conflict was represented by a French act of aggression, in which case provision had been made for *absolute defence not only on the Alpine front but also the Libyan one*. Therefore: *the plan studied for Egypt no longer had a raison d'être: and, where Libya was in question, everything must be directed towards the West*.¹¹

It is clear that similar indecision and fluctuations of a politico-strategical nature, which Badoglio should have tried to obviate by encouraging Mussolini to make timely choices, prevented any type of co-ordination in terms of military preparation. Therefore the eve of the battle was reached without the Italians knowing whether they would have predominantly to fight a

Continental or a Mediterranean-African war, so that no necessary choices of either a military or an industrial nature could be made. Who, for example, could say whether the Air Force should have prepared torpedo-planes or strategic bombers or attack aircraft?

The technical problem of Italy's aeronautical industry's inferiority revolves around these contradictions and an indecision and lack of co-ordination to which the second section of this chapter will be dedicated.

Section 2: The Engine Problem

One of the arguments most widely used to explain the limitations of RA performance is the dearth of Italian engines with performances similar to those of foreign ones. This fact has caused a fair amount of comment even among foreign experts and historians, not only because of the well-known reputation of the Italian motor industry, but also on account of some aircraft exploits, such as Agello's world speed record and the Atlantic crossings, which have always caused the rest of the world to presume that Italian military construction was of the same high level.

Unfortunately, the above does not hold true on account of previous mistaken choices, not only of a military but also of an industrial nature.

There is no doubt that, although the Italian car industry did boast considerable fame, the problems connected with the construction of an aircraft engine are known to be far more complex than those of car propulsors (even those with a high performance level), and therefore only a small part of this experience could be used in the other field.

For example, the high displacement of some aircraft engines, with a capacity of some ten litres, demanded extremely refined design techniques, not only for the cylinder heads but also for the pistons, in order to achieve the highest engine-power results. This meant that it was necessary to solve a series of rather delicate balances, including the number, the lift, the diameter and the positioning of the valves, the number and position of the sparking-plugs, the compression ratio and the shape of the combustion chamber. This result could only be achieved by means of the intelligent and patient analysis of thousands of possibilities, which might even prove to be altogether vain. The

need to generate maximum power at speeds considered unusually low for a car engine (at most approximately 3000 rpm) in order not to have to use reduction gears with an excessive transmission ratio to maintain the speed at the end of the propeller blades within values sufficiently lower than the sound value, only helped to make this problem even more difficult. The low angular speed and, consequently, the poor average speed of the pistons, was certainly no help in introducing the mixture into the combustion chamber. Poor control of turbulence, accentuated by the need to use low compression ratios (which we will return to later on), resulted in the incomplete combustion of all the mixture introduced, with consequently very low thermodynamic efficiency and the subsequent combustion of part of the mixture expelled from the exhaust manifold after coming into contact with red-hot surfaces situated in a more oxygen-rich area. This phenomenon is similar to the dangerous long tongues of fire sometimes emitted from turbo-charged engines during the slowing-down phase, i.e. when the inertia of the supercharger causes a larger amount of mixture than that which is burnt up to be introduced into the cylinders.

Although we do not, here, wish to discuss either internal combustion engines in general or aircraft engines in particular (information about which can be obtained from other texts), it might none the less be interesting to remember how even a conventional Formula 1 engine like the British Cosworth DFV achieved an almost 50 per cent power increase over a ten-year period simply by tuning pistons and cylinder heads properly. To return to the subject, it is necessary to remember that the justifiably famous Rolls Royce 'Merlin' was simply an upsizing of the 1927 Kestrel to 271 from the original (1927) 21.41 displacement. The origins of the 'Kestrel', the American Curtiss D12's most famous child, dating from 1918, were none the less European (Hispano-Suiza). Without going into details about the history of all the innovations introduced by Charles B. Kirkham (the father of Curtiss D.12) into Mark Birgikt's (designer of the Hisso's, as the British called the Hispano-Suiza engines) original idea, there is no doubt that we are in full agreement with the statement that 'the Merlin profited from a dose of British patient persistence in debugging'.¹² No other explanation can be given for the early retirement of the still 'young' but more modern Allison V-1710, which, if correctly tuned, could, still today, outperform every other Allied in-line engine.¹³

Two points, considered fundamental by the authors, emerge from the above:

1. Even for a giant like General Motors, five years were not enough to thoroughly tune an engine¹⁴ which, although innovative in some ways, for example, the shape of the combustion chamber derived from the Offenhauser engines which won at Indianapolis, could not be considered revolutionary.
2. Confronted with facts, the policy of a few steps at a time proved to pay off much better in aircraft engines, for which reliability is of the essence and working conditions are extremely varied, and, last but not least, for which there is also the need to have optimum efficiency at all altitudes. Just as General Motors did not fully achieve its goal, once again showing the enormous difference between aircraft engines and car engines, the same point can be applied to Italian industries such as Fiat, Isotta Fraschini and Alfa Romeo, whose reputations in the field of civil land transportation were without blemish.

These three were the principal Italian manufacturers of large aircraft engines. Piaggio, completely without experience in the automobile field, was added to these in the 1930s. Even Italian designs, like the 'Merlin', have complicated origins. During the First World War German influence was predominant, and not only Fiat but also Isotta Fraschini, like many other Allied firms, copied, either with subtle differences or even fully reproducing them, Daimler's in-line six cylinders. After the war, the production of the two main firms was diversified: Isotta Fraschini took the Lorraine-Dietrich licence while, ostensibly, Fiat continued to produce original designs. It goes without saying that the term 'original' is intended in a relative sense, in that each engine is always the result not only of the direct experience of the designer, but also of his competitors.

Bearing this particular subject in mind, it is especially interesting to note that, for a long time, neither Fiat nor Isotta Fraschini even bothered to keep up-to-date with what today we know to have been the evolution of aircraft piston engines. In fact, until the outbreak of the war all the in-line water-cooled engines constructed by these two firms were characterised by a single technique – a technique that had been abandoned by the Americans and British in the early 1920s: the use of separated

cylinders, with a water-jacket fastened to each of them. This technical solution resulted in an increase in weight, a lower rigidity of the crankcase and cylinder heads and a more complex construction: all factors involving not only increased costs and time, but also a total inability to make any further developments. It is not mere chance that the Italian liquid-cooled engines belonging to the last generation before the war (the Isotta Fraschini Asso XI R with approximately 850 hp) proved to be a failure, thus preventing any further development, owing to the very limits imposed by this type of construction in the search for increased power.

It is true that of the aircraft engines *mass-produced* between 1928 and 1935, the Italian ones can be said to be considered the best among those with separate cylinders, although it was in fact during that period that other nations had abandoned this construction technique in order to dedicate themselves to experimenting with the construction of cast-block cylinders. Had the latter not made this courageous choice, there would have been no engines on the market, in 1940, capable of developing to become even more powerful. While the failure of Isotta Fraschini can be attributed not only to the Lorraine-Dietrich licences but also, partially, to industrial inexperience, no excuses can be made for Fiat who, as early as 1923, had received, from the Air Ministry, the first Curtiss D.12s imported for the Schneider Trophy. And yet this Turin firm transplanted almost every element of the Curtiss in the A.20, progenitor of all the Fiat in-line propulsion units. The only 'novel' feature of the A.20 was a return to traditional separate cylinders: or rather Fiat, differing from Rolls Royce and Curtiss in this, has not even noticed the most prominent innovation in the American engine.

When, in 1933, it became clear even in Italy that a 'cul-de-sac' had been reached *vis-à-vis* in-line engines, a decision was taken to employ the radial air-cooled type for high-power engines. The advantages deriving from a lower weight and the diffusion of improved cowlings from an aerodynamic point of view led to the realisation that, as was the case abroad, it was possible to manufacture planes with performances comparable to those of aircraft equipped with in-line engines having a smaller frontal section. Since no significant construction experience was available in this field, Alfa Romeo bought the English Bristol's licence, not disdaining, at that time, to copy the Gnome-Rhone derivatives. Following re-production of the Gnome-Rhone 14 Ksd, Fiat bought the Hornet engine from Pratt & Whitney. The

influence of this American company is evident both in the A.74, a Twin Wasp with a slightly longer stroke, and the A.80, obtained from a combination of the two Hornets.

The fact that the Fiat designers did not master these technologies is confirmed by the fact that Italian engines retained the same cylinders, pistons and heads as the originals – the most difficult to design – obtaining models with larger cylinders simply by increasing the stroke. The same applied to Piaggio and Isotta Fraschini, neither of whom ever managed to eliminate the defects of the original engines completely.

This is one of the main reasons why the RA was so unprepared for the race for power that took place during the Second World War. In Italy, there was no consolidated experience in the field of aircraft engines, and the little that was known about liquid-cooled engines became, for the most part, a useless burden when the Italians decided to change to air-cooled engines. But, instead of looking further for other causes, it is necessary to remember that the state of diffused backwardness in the field of engines was not helped in any way by the poor range offered by the accessories industries. Nor could any praise be given in the field of airscrews where, apart from the unresolved problems of pitch-control reliability, the Reed design propellers manufactured by Caproni were followed by the Hamiltons produced by Fiat (also taken from SIAI) and finally by the Alfa Romeo, also clearly inspired by foreign models. Only Piaggio produced originally, developing a patent deposited by the engineer D'Ascanio, although some comparisons with aircraft equipped both with these propellers and the German VDM evidenced German superiority in terms of the aerodynamic concept. The same applied to Italian carburettors and sparking-plugs, a field in which national industry was technologically dependent on its foreign competitors, meaning that, with the onset of war, it was automatically excluded from the progress taking place elsewhere.

The attainment of optimum performance in an aircraft engine depended on these fundamental details:

1. The risk of ice forming in the throttle valves could be resolved by using a technologically advanced carburettor, as shown by the American Stromberg in 1939.
2. The problem of corrosion of the sparking-plug electrodes, caused by high percentages of tetraethyl lead, used to increase the anti-knocking quality of the fuel, was solved by

using platinum electrodes, as was demonstrated by the British KLG.

The fuel problem gives rise to other questions. In Italy there was a tendency to sit back and watch progress in this field. Problems arising from low temperatures at high altitudes require low-volatility fuels, which can be obtained by means of a continuous distillation process within a limited temperature-range (between 50°C and 120°C). However, if a high octane-rating is required, it is necessary either to start off with an oil rich in aromatics or to use anti-knocking additives, which do, however, tend to increase corrosion. Furthermore, 80-87 NO is a limit that is difficult to overcome using traditional distillation processes. During the early 1930s in the USA first a cracking process was used, and later a hydrogenation one. The latter process was also adopted in Great Britain and Germany. These two processes were finally followed by alkylation, which yielded fuels with an octane-rating of over 100, and iso-octane percentages of approximately 50 per cent. Despite its position of supremacy in the field of synthetic fuels, Germany, in 1940, also adopted the alkylation process, achieving power increases, on a level with the USA and Great Britain, of approximately 30-35 per cent while still using the same engines. The situation in Italy was definitely not ideal in terms of oil supplies, never of the best quality; but the difference became almost abysmal owing to the shortcomings of the petrochemical industry, which, like the motor industry, neglected research. This gap became unbridgeable owing to the use of castor oil rather than mineral-based lubricants, whose poor characteristics of stability were the cause of numerous problems, though even these were exceeded in number by those caused by the first modest domestic mineral oils, which proved lethal for valves, rings and pistons.

Abroad, for example in Great Britain, there were those who patiently perfected an old project, or even those who made up for time lost by obtaining results with new, more refined mechanisms, among which we recall, for example, the turbo-chargers and fuel injection, both primarily of German origin, and the use of mixtures of water and methanol or nitrous oxide, to be injected into the cylinders to improve the anti-knocking qualities of the fuel, thus obtaining considerable increases of power to be used in emergency conditions. In the field of aero-engines in Italy neither patience nor ingenuity were shown, and the few attempts made to improve the general situation were all hastily

aborted. For example, in 1938 Piaggio, as a private venture, perfected an engine prototype, the P.X.I.R.C.44. This operated on 100 octane fuel, so that a Reggiane Re.2,000 could reach 535 km/h, thus improving the maximum speed by about 30 km/h.¹⁵ However, this was not appreciated by Francesco Pricolo, who during a meeting held on 20 March 1940 on the development of the RA, condemned similar initiatives, asking that 'construction industries be suitably disciplined so that, instead of designing new types leading not only to non-uniformity but also going against attempts made towards normalisation, improvements could be studied for use in mass-produced engines to guarantee perfect functioning'.

The minutes of the meeting continue as follows:

With regard to P.XI engines designed to function on 100 octane fuel, there has been much discussion about the advantages that can be obtained with the use of 100 octane fuel and the possibility of producing iso-octane in Italy.

His excellency, General Ferrari, states that the Direzione Superiore Studi e Esperienze has already gone into the problem thoroughly, and has presented an in-depth report regarding this subject to which there was no follow-up. His excellency the Undersecretary of the RA [Pricolo] declares that this shows lack of follow-through, in that if one is interested in a subject, it is necessary to follow it up, even if it has been passed to another body, because it is inadmissible that important initiatives be set aside without any practical results being obtained.

His excellency General Ferrari assures us that in Italy the necessary amount of 100 octane fuel can be produced by mixing normal fuel and iso-octane in an equal measure; the latter can be obtained by working the gas obtained by means of the cracking process in refineries.

The Direzione Superiore Studi e Esperienze had asked the State Hydrocarbon Company ANIC to carry out a plant project for the production of iso-octane.

It would be necessary to once again take up this issue with the ANIC to have not only a cost quotation of the plant but also information about the supply conditions of iso-octane.

His excellency the Undersecretary of the RA considers that it is a good idea to encourage the ANIC to produce iso-octane and gives the Direzione Superiore Studi e Esperienze a mandate to sign the necessary agreements.¹⁶

But this time, too, no practical results were reached, owing, above all, to the fact that in order to exploit such a plant, besides the obvious logistic problems created by the use of two different types of fuels and the duplication of engine types, it would have been necessary to force the other Italian firms either to re-design their engines for this new fuel or to manufacture the one designed by Piaggio under licence. This engine, truth to tell, was never perfectly tuned, not even in the traditional-fuel version.

It is understandable that entry into the war interrupted such an initiative. But this neither changes nor excuses the behaviour of the previous years. In fact, since at least 1934, the Italians had frittered away their time, ignoring all technology-related problems. This delay did not depend on a lack of raw material but rather on human failings, in that the chemical process did not depend on the characteristics of the oil used.

Section 3: The Airframe Problem

Everything that has been said about the recognised deficiencies in the engine field has led many to the conclusion that Italian airframes were on a par with foreign ones. This supposition was also backed up by the fair commercial success of Italian military aircraft in some nations. Japanese, French, Swedish, Finnish and Hungarian orders, and the British interest shown in the Caproni reconnaissance aircraft and the Reggiane fighter planes, can, if improperly analysed, lead to these beliefs.

This subject should be gone into in depth both from an industrial and a design point of view, not forgetting (this is not only an Italian problem) that it was not always the best aircraft that won the specification competition.

We would, in fact, like to refresh your memories about several instances of similar behaviour in France, Great Britain and Germany, where, in particular, reasons of a prevalently political nature gave preference to the excellent Bf109 rather than the even more superior He.112. In the hopes that some colleague can solve our questions using either technically or historically valid arguments to explain the choices made in some of the above-mentioned nations, we will now return to the Italian case, always bearing in mind that an objective partial parameter of comparison between the various designs could be the equations

of equilibrium of horizontal and vertical translation for an aircraft:

$$\begin{aligned} \text{THP}_a &= D \\ W &= L \end{aligned}$$

where:

- D = overall drag at the maximum speed in kg = $\frac{1}{2} k_d r S V^2$
- L = overall lift at the maximum speed in kg = $\frac{1}{2} k_l r S V^2$
- THP_a = propeller thrust available in kg = $\pi P / V$
- W = gross weight (weight fully loaded) in kg
- P = maximum power at the height of maximum speed in kg m s⁻¹
- S = wing surface in m²
- V = maximum speed in m s⁻¹
- k_d = absolute overall drag coefficient
- k_l = absolute lift coefficient
- π = airscrew efficiency
- r = air density at the height of maximum speed in kg m⁻³ s²

Dividing the two equations, we obtain a figure of merit of the 'goodness' of an aeroplane:

$$E = \frac{\pi k_l}{k_d} = \frac{V \times W}{P \times 270}$$

with V in km/h, P in hp and '270' indicating the conversion factor for hp.

For example the Italian fighter Macchi C.200 (M.M.4526), during the type tests held in February 1940, reached a maximum speed V of 496 km/h within 4,200 m, with a total weight W of 2,450 kg and a power P of 840 hp at a maximum-speed altitude, with an efficiency E of 5.358. The similar Mitsubishi A6M2 Model 21, also with a radial engine, although reaching 531 km/h with a weight of 2,410 kg and a power of 950 hp only had an overall efficiency value of 4.98, while the less imposing Fiat G.50 (M.M. 4957), despite only reaching 469 km/h with a weight of 2,696 kg and the same power as the Macchi C. 200 model, had a much higher aerodynamic efficiency (E = 5.57).

On the basis of the above, a more technical approach is needed in order to evaluate the 'goodness' of the different constructions. The formula proposed, well-known to those involved in flight mechanics, gives the impression that there is not such a great difference between the efficiency of the two

main 1940 Italian fighter models and that of similar foreign aircraft. This is not the case, because the formula in question only reflects, in the context of the same machine, the balance between the varying performances, the installed power and the overall weight. Since this is an expression of efficiency, it does not concern the maximum performance level. We are in fact convinced that Italian pilots were not particularly concerned about the fact that their Fiat G.50s were much more efficient, from an aerodynamic point of view, than the Hawker Hurricane IIB, which, despite having an E value equal to 4.47, could, however, reach 526 km/h thanks to the 1,435 hp generated by the Merlin XX engine. The current idea that the 'wings of Italian aircraft were clipped' by radial engines is, therefore, mistaken. There are no technical grounds for this assumption, in that the two Italian fighters exploited the available power to much greater advantage than their British competitor, also fitted out with an in-line engine.

Were this not true there would be no explanation, for example, for the success of US Navy fighters and the Republic 'Thunderbolt' which, despite all having radial engines that at first sight appeared not to have smooth profiles, none the less managed to obtain both extremely high speed performances and aerodynamic efficiencies.

However, it is also true that in Italy a threshold of 1,000 hp was never reached with reliable radial engines. This, more than any other reason, and not the increased frontal dimensions, constituted an unsurmountable constraint to the development of aircraft.

But the design techniques of Italian aircraft were also affected by other serious problems. If, on the one hand, Italian designers managed to obtain good aerodynamic penetration in their aircraft, on the other it is necessary to remember how the majority of them dealt with the monoplane problem in a totally imprudent fashion. Were this not the case there would be no explanation for the use of wings with a constant aerofoil profile both in the Macchi C.200 and the Fiat G.50. The use of the above was one of the main reasons for the tendency to spinning instability, a phenomenon made worse by our pilots' habits with biplanes, which facilitated aerobatic flight attitudes, without the pilots' requiring any particular training. Indubitably, the sequence of accidents with the first operational monoplane fighters facilitated the persistence of biplanes in the RA, the last of the great Air Forces to use them in operative fighter squadrons. But what then is there to say on discovering that, among the

competitors taking part in the fighter specification competition of 1938, both the Reggiane 2,000 and Caproni Vizzola F.5 were not only present but also fitted out with wings with a variable aerofoil profile. Our amazement increases as we note that, scientifically speaking, even in Italy the superiority of wings with a variable aerofoil profile had been shown in the early 1930s.

When analysing the construction technique of the fuselages we note that a Macchi C.200 had an empty weight (i.e. without guns, fuel, lubricants or radio) of 1,980 kg, meaning that the airframe alone weighed about 1,380 kg, a fact that can only be attributed to insufficient knowledge of metal construction. A modern-day designer, comparing Italian and foreign constructions of the early 1940s, would have the curious impression that the Italians had substituted for the wooden girders a similar structure made from some other kind of material, thus discarding a good part of the practical advantages offered by metal constructions in terms of lightness versus resistance. The advantages of the undeniable solidity of some Italian constructions are hard to see: for example, take the Breda 64 and 65, where the traditional metal structure, made from chrome-molybdenum-steel tubing, was completely covered with a monocoque dural skin – in effect, two fuselages superimposed on each other within a single aircraft.

None the less, compared with contemporary foreign constructions, which, in order not to statically stress the wing structure, carried the bracing struts in the fuselage (a solution typical of German aircraft) or near to the cantilever wing fastener, the Italian use of wide-track landing gear is worthy of note. The poor handling characteristics during take-off and landing (typical for example of the Messerschmitt Bf 109 and the Supermarine Spitfire), resulting from the above type of construction indubitably contributed to making a large number of aircraft unserviceable during these delicate phases.

However, the fact that domestic constructions were more solid was not used to increase the useful load of Italian aircraft, and the problem of installing wing guns was only really solved when the war was already in full swing. This subject is obviously extremely complex, and involves not only the availability of guns, but also some irrational demands made by RA specifications. Owing to lack of space this particular subject cannot be dealt with in this particular paper. None the less, despite this lack of guns,¹⁷ the unfortunate results of the Fiat CR 32 *bis* (twin

12.7-mm guns in the top cowling supplemented by twin 7.7-mm guns mounted inboard the lower wings, later relinquished) and on the Breda 64 and 65 caused the solution of wing-mounted guns to be abandoned, without the causes for this decline in flight performance being thoroughly solved, together with the poor accuracy of the wing-mounted machine-gun, owing to the vibrations induced in the wings by a succession of firings. A more modern design technique would have been able to solve the problem by better exploiting the quantity of steel used, even randomly, in the construction of an aircraft.

Generally speaking, ideas regarding the design of airframes were also not particularly clear. Some examples follow:

(a) the Fiat 8.R. 20, twin-engined winner of the 1934 specification, which should have acted as the backbone of the medium-bomber squadrons, was affected by problems involving the Fiat A.80 engines, the early production types of which were without forced lubrication of rockers and valves (in 1936!). Furthermore, owing to a rather high rotation speed by Italian standards, some wing ribs also resonated, not only causing the wing to collapse but also giving rise to an unpleasant phenomenon whereby the rivetings were literally shot away. Foreign industries had been aware of this problem for some time, so that the single riveting along the parallel and perpendicular lines had been replaced by zigzag riveting.

(b) the SIAI S.79, the most famous Italian bomber aircraft designed by the highly reputable engineer Alessandro Marchetti, was never intended for that purpose, but rather designed as a high-performance commercial aircraft. The good sporting results obtained with this aircraft caused a military derivative to be studied. However, this derivative was simply a rearrangement of the original mode, not capable of exceeding the limits imposed by its initial purpose. Let us remember that the narrow width of the fuselage meant that the bombs had to be stored vertically in the bomb-bay, causing them to be dispersed on release. A development of this was studied (the S.M.84, originally S.79 *bis*) by organically redesigning the whole to satisfy military requirements. Despite this, the aircraft proved to be the worst, if gradation is possible, of all the in-line Italian bombers. In fact, it was almost as if the S.79 were the work of a different designer and not of engineer Marchetti.

This, therefore, leads us to the conclusion that considerable lacunae also existed in the airframe context.

Industry, totally inadequate in the field of military multi-engined aircraft, did the best it could in the field of single-engined fighters, but even when Daimler Benz engines were available, the results, like the engine, were certainly not superior to the German ones in terms of mere speed performances. There remained, none the less, a firm ignorance not only in the aerodynamic field, where elegance of form was confused with aerodynamic drag and lift, but also in the engineering design of prototypes. In fact, the Italian designs proved to pay no heed whatsoever to the need for mass production, resulting in obvious disadvantages that could be measured in terms not only of time but also of money, once again disproving the primacy of the negative influence of the lack of raw materials.

To give the kind of importance to the lack of raw materials attributed to it by many historians and memorialists, it must be assumed that the best-known Italian designers (men like Castoldi, Gabrielli, Marchetti and Rosatelli, etc.) really thought that each individual aircraft could only be constructed by artistically sculpting huge metal blocks, and that veneration for their 'maestros' meant that the idea of reusing scrap was absolutely unthinkable.

Only problems of space keep us from mentioning other important aspects such as, for example, orders for industry and the quality of the men who either directly or indirectly influenced the way of life of the RA in those years.

Notes

1. For reasons of space it is not possible to go into more detail. For any extra information on the subject see papers about the RA by Giorgio Rochat, Lucio Ceva, Giorgio Apostolo, Andrea Curami and Giancarlo Garelo on pp. 19-30, 191-9, 257-92 of *Colloque International*, published by the Institut d'Histoire des conflits contemporains and the Service Historique de l'Armée de l'Air in Paris, 1985, which contains all the papers presented at the 'Air 84' conference held in Paris, 4-7 September 1984.
2. Giulio Douhet, *Il dominio dell' aria*, Rome, 1955, pp. 167-8.
3. For further information about the questions in this paragraph, see the papers mentioned in note 1.
4. Only one work is known on the subject: Giorgio Rochat, *Italo Balbo*, Turin, 1986, which is a development of another: *Italo Balbo aviatore e ministro*

dell'aeronautica 1926-1933, Ferrara, 1979. Other publications also exist, such as the book by Giordano Bruno Guerri, *Italo Balbo*, Milan, 1984, which includes some interesting documents.

5. The report was published by the 'Italian Aviation Research Branch of Air Britain', nos. 3-4, 1976, pp. 65-74 and 118. With regard to the former see also L. Ceva, 'Lo sviluppo degli aerei militari in Italia (1938-1940)', *Il Risorgimento* (Milan), no. 1/1983, pp. 26-45.
6. L. Ceva, 'Aspetti politici e giuridici dell'alto comando militare in Italia', *Il Politico* (Pavia), 1984, no. 1, pp. 81-120, p. 104.
7. See texts given in note 1.
8. See, among other research, Ernesto Cianci, *Nascita dello stato imprenditore in Italia*, Milan, 1977, above all pp. 209-40.
9. A direct quote (also for archival purposes) taken from a paper by A. Curami and G. Apostolo on 'Italian Aviation from 1923 to 1933' in the volume mentioned in note 1.
10. Benito Mussolini, *Opera Omnia*, Florence, 1951-63, 36 vols, vol. XXII, pp. 366-7.
11. For comparison between the meetings of 2 December 1937 and 26 January 1939 see L. Ceva, 'Appunti per una storia dello Stato Maggiore Generale fino alla vigilia della "non belligeranza" (giugno 1925-luglio 1939)', *Storia Contemporanea*, no. 2/1979, pp. 207-52, pp. 235-46.
12. Herschel Smith, *A History of Aircraft Piston Engines. From the Manly Baltse to the Continental Tiara*, Manhattan, KS, 1986, p. 42.
13. The Allison (this firm became a General Motors component from 1935) V-1710 was the only American liquid-cooled engine to see service in the Second World War. The V-1710 F30, a typical wartime version, had a slightly higher displacement, weighed less and was more powerful than the contemporary version of the 'Merlin', but its use was limited to the P.38, P.39 and P.40, being replaced by the British engine in the P.51 Mustang.
14. This observation could also be applied to Germany, where, apart from the many failures common to all wartime countries, the need to overhaul the Daimler Benz DB only after some 20 flight hours created some not indifferent logistic problems compared with the 600-700 hours of the Merlin and Allison belonging to the allies.
15. Meaning a presumable power increase of only about 16 per cent, as against 30-35 per cent of similar foreign experience.
16. The minutes, consisting of 67 typewritten sheets, were kindly given to us by our friend Commander Giancarlo Garelo.
17. It should not be forgotten that the first aircraft designed for wing-mounted machine-guns were the Macchi C.202s of the ninth production batch, delivered from the beginning of April 1942; but the lack of guns prevented all the aircraft being equipped with the two modest 7.7 mm (.303) guns originally programmed.

5

Commentary

Richard J. Overy

The conduct of air warfare in the Second World War was fundamentally conditioned by the performance of the aircraft industries. In Germany and Italy the aircraft industry failed to match the output levels of their enemies, and failed to maintain the qualitative advantage that Italian aircraft enjoyed in the early 1930s and German aircraft later in the decade. This question of economic and technical efficiency is the common theme addressed by Boelcke, Ceva and Curami. They succeed in showing that there is no simple answer. Problems of production have to be understood in the wider context of political and administrative structures and of the relationship between industry and the state.

It could of course be argued that the problem was ultimately one of resources. Yet in 1944 Germany produced three times as many aircraft as she had produced in 1941 with almost the same resource base; Italy was constrained by a lack of raw materials and factory capacity, but Japan, another relatively less developed industrial economy, managed to produce by 1944 almost as many aircraft as Germany. Nor was the problem one of technological backwardness, for both states had produced some of the world's most advanced aircraft in the 1930s, and Germany was pioneering jet engines and rockets when war broke out.

A more powerful objection might be that both states did not perceive the need to produce more or better aircraft, that a limited strategic conception shaped their productive performance. But this, too, is hard to sustain; German aircraft production ran consistently behind schedule from 1938 onwards, and very much below the high demands formulated by Hitler before the outbreak of war. When in July 1940 Hitler gave priority to aircraft production for the war in the west the result, paradoxically, was a slow decline in monthly output to the catastrophic

position in the summer of 1941, which produced a revolution in air production based on the so-called the 'Goering Programme'.¹

The evidence suggests that it was not a lack of strategic commitment but a problem of industrial efficiency and the effective utilisation of resources. Given the quantity of raw materials and manpower allocated to it, the German economy was capable of producing many more aircraft in 1940-2 than it actually did. The British aircraft industry had less labour, floorspace and aluminium early in the war, but produced almost double the number of aircraft, with a greater total weight, than the German industry. By 1944 German production was much more efficient; but by then the damage was done, and Germany was producing 36,000 aircraft to the 167,000 of her enemies.

The chapters of Boelcke, Ceva and Curami suggest two kinds of explanation. The first is a political one: those ultimately responsible for the strategic decisions that governed aircraft production were guilty of poor judgement, wishful thinking and muddled planning. In Italy it was Mussolini himself who acted as the central co-ordinator of the three service departments and of the decisions on economic strategy. He spent too little time on defence questions, but failed to construct an alternative administration or planning structure with a clear view of Italian strategy and the technical resources needed to fulfil it. In Germany Goering, who was a poor strategic thinker and administrator himself, left the task of co-ordinating Germany's large and complex aviation industry to Ernst Udet, a man manifestly unfitted for the job by his own admission. These leadership problems not only inhibited good judgement and effective planning, but had the secondary effect of reducing the influence and access of qualified personnel who could have supplied it (the exclusion of Erhard Milch from production planning from 1939 to 1941 is a good example), and in stifling the initiative of airmen and industrialists who could have done more. Moreover the aircraft industry was such a large part of the economic war effort that its poor central leadership produced a damaging effect throughout the whole industrial system. The confusion in allocating contracts and making technical decisions evident from these papers stemmed from this central deficiency. Aircraft production required very difficult decisions, as every warring state discovered. Mistakes were made on both sides, but in Germany and Italy the chances of error were increased by the nature of the political system.

The second explanation common to both countries was the

relationship between state and industry. It is argued that a high dependence on state orders and money had the effect of reducing entrepreneurial initiative and creating an over-bureaucratised system in which businessmen found themselves tied up in red tape or simply told what to do by desk-bound soldiers. The implication is that *dirigisme* does not work if you want large quantities of complex military equipment produced on time. The problem was made worse, as both Boelcke and Ceva make evident, by the character of the entrepreneur group, which was drawn very much from the 'inventor' side of aviation. Its interest remained very much in the technical, inventive aspects of production, with regular and even radical innovation, rather than in questions of production in mass. It was the loss of any real initiative as inventors that alienated them from state control. There is much truth in this picture. When Admiral Lahs, head of Wirtschaftsgroupe Luftfahrtindustrie, looked back in 1945 to the failures of the war period, he singled out the failure to respect business independence:² 'Der Generalluftzeugmeister mit seinen mehreren Tausenden von Referenten, Angestellten und Mitarbeitern hat praktisch die Industrie selbst geführt.' (The Generalluftzeugmeister, with his many thousands of advisors, employees and collaborators, practically ran the industry himself.) But the hostility of inventive entrepreneurs does not explain in the German case why the successful industrial firms drafted in to take over much aircraft production during the 1930s (such as Henschel or Daimler-Benz), or the state-owned Junkers concern run by the industrialist Heinrich Koppenberg, were infected by the system in the same way as Messerschmitt or Heinkel.

Yet the problem was not so much state orders, since all aviation industries depended on them during the rearmament and war period, nor state regulation (the Soviet performance is testimony to this) but the failure to produce an adequate structure for planning the allocation of resources and making the key technical decisions. These choices rested on the development of a central forum for effective decision-making and co-ordination. In Britain this was not created by private initiative either, but by the state, through the Ministry of Aircraft Production. In both the German and Italian cases excessive state direction is not an explanation in itself: the explanation must rest on a careful and critical reconstruction of the detailed processes whereby decisions were reached, communicated and enforced. Nor should it be forgotten that some of the problem rested with industry as

well. Curami has demonstrated that the trouble with Italian aero-engine development was the lack of imagination or technical enterprise on the part of the producers. In Germany too the managers and entrepreneurs, in the face of the state's determination to regulate the industry, adopted a defensive and conservative position towards the state apparatus which discouraged innovation in production methods and organisation. Moreover many of them found it difficult, as their businesses grew from small workshops to giant concerns, to cope with the managerial demands raised by changes in scale. Difficulties with production could be caused from both sides. The state depended on the industry's taking risks and offering radical solutions, just as industry depended on clear guidelines and a flexible system of evaluation and direction.

There is a third explanation which neither chapter explores in any depth, and that is the relationship between industry and the air force itself. In both states the military establishment assumed responsibility for overseeing war production, in establishing the 'militarisation' of industry. This carried all kinds of dangers. John Morrow cites Helfferich in discussing the First World War: 'an army suffers itself to be ordered about, but an economy does not'.³ Yet in 1939 the German military hoped to take up where they had left off under Hindenburg and Ludendorff in 1918, with a military command economy. This was not necessarily a problem: it became so when the military insisted on giving absolute priority to the tactical requirements of the front over questions of efficient production, and when they insisted on placing qualified military personnel in every aircraft and aero-engine plant to make sure that the high standards and regular modifications that they demanded were being met. In the other major states production was left much more in the hands of civilians and bureaucrats. The air force said what it wanted, but it left others to produce the aircraft in quantity.

In Germany and Italy the aircraft producers found themselves imprisoned between an ineffective economic administration on the one side and powerful military intervention on the other. It is small wonder that some German producers simply gave up the struggle and carried out orders from men who knew less than they did about mass production, engineering and resource distribution. Only after 1941, when the crisis over aircraft production was out in the open, did this situation begin to change. It was solved by a thorough programme of rationalisation ordered by Hitler himself, which transformed the productive

performance of German industry.⁴ At Messerschmitt the introduction of flow-production methods reduced construction time on the Me 109 by 53 per cent in eighteen months. At BMW production time per engine was cut by 60 per cent. These changes permitted the use of less skilled labour too. At Henschel production time per unit fell by 50 per cent in 1942, but the number of skilled workers dropped from 45 per cent of the workforce in 1939 to only 11.7 per cent in 1943.⁵ Rationalisation involved the gradual exclusion of the military and the officials of the Goering organisation from decision-making, and the establishment of a civilian structure based on the Speer Ministry which managed the allocation of resources and end-production with the help of men with commercial and engineering experience.

Explaining comparative economic performance requires detailed research on the problems of innovation, technical development, research, and production engineering. It requires detailed analysis of the administrative and decision-making procedures that shaped procurement policy. But in the end the efficient mobilisation of resources comes back to the political sphere. It can hardly be fortuitous that these problems assumed an acute form in the two European Axis dictatorships. The nature of the political goals and the state apparatus of German and Italian Fascism magnified the difficulties that all states shared in war economics. These were regimes in which decisions were difficult to challenge and failure was slow to be reversed, in which conviction often masqueraded as judgement and political will replaced rational evaluation.

Notes

1. Imperial War Museum (IWM), FD 4355/45, 'RLM Industrierat, Leistungssteigerung in der Fertigung von Luftwaffengerät', 15 Aug. 1941.
2. IWM, Fieseler papers, Admiral Lohs memorandum, 1 Jan. 1945, p. 5.
3. J. H. Morrow, 'The German Aircraft Industry in the First and Second World Wars' (Chapter 2 and p. 34 of the present volume).
4. See R. J. Overy, 'Mobilization for Total War in Germany, 1939-1941', *English Historical Review*, 103, 1988, pp. 632-3.
5. IWM, Messerschmitt papers, FD 4921/45 Folder 1, p. 6; BMW papers, FD 4969/45 Report 2, p. 25; Henschel papers, FD 3224/45 1. 'Leistungssteigerung seit Kriegsbeginn', 28 Dec. 1943.

PART III

The Military, Research, Technology

6

German Aircraft Production, 1918–1939

Edward L. Homze

A few feet from the Berlin Wall in the Invaliden Cemetery stands a simple tombstone with the name Richthofen carved in block letters. Beneath it lies the remains of Germany's greatest world war flying ace, Manfred von Richthofen. Seven years after his death over France, the body of the fabled 'red Baron' was returned to the Reich for a state funeral. The victors of the First World War hoped that the German Air Force and its creators were as safely interred as its greatest combat hero. Yet within ten years of that cold, raw day of 28 November in 1925 when the Baron's body was ceremonially laid to rest, a new German Air Force had emerged to threaten the skies of Europe.

From 1935 to 1939 this new Luftwaffe, ably led and supported by the Reich Air Ministry and the German air industry, played a conspicuous role in determining the fate of the European nations. How was it possible for the Germans to rebuild their air power so quickly? or, better perhaps, how had it happened that the victors of the First World War, so conscious of the potential of German air power, had allowed this formidable genie to slip from its tightly corked bottle?

The German air industry which had built such a powerful air force during the First World War had grown from a modest start of ten aero-engine and fifty aircraft and parts companies of 'glorified garage' dimensions to a mature industry of twenty-six aero-engine and thirty-five aircraft companies employing thousands. During the war it had produced approximately 44,000 aircraft and 40,000 engines, and it was only beginning to reach its full production stride of 2,000 aircraft a month when the war ended.¹ Keenly aware of the potential of air weapons in the future, the victorious Allies sought to crush German aviation through the peace treaties.

The Treaty of Versailles prohibited all military flying for the new truncated German army while forcing the Germans to hand over or destroy approximately 15,000 aircraft, 20,000 engines, and 16 airships, and dismantle about 1,000,000 square metres of hangars.² An Inter-Allied Aviation Inspection Committee, was organised to enforce the provisions of the treaty.³ Civil aviation production was blocked effectively by the Allies until 5 May 1922, when the Germans were again allowed to begin operations under the so-called technical 'definitions' of the Allied powers. The definitions sought to reduce the technical capability of the German air industry by limiting the maximum speed, payload, service ceiling and range of German-built aircraft to standards of development well below those of the time.⁴ The Allies, however, found enforcement of the air provisions at best difficult, as the Germans evaded or cleverly turned the restrictions against the Allies.⁵ By 1926 the Allies lifted all restrictions on civilian aviation with the Paris Air Agreement, while still prohibiting military aviation. Six years after the Treaty of Versailles Germany's civil aviation was freed from all fetters.

Although military aviation was proscribed by the Treaty, theoretical studies of air power continued in the new Reichswehr's camouflaged General Staff, the *Truppenamt*. The experiences of the First World War were restudied and evaluated, while the progress of foreign military aviation was carefully monitored. Practical military aviation was fostered at home through sports flying, gliding and commercial aviation, while abroad the Reichswehr opened a secret training and testing base in the Soviet Union.⁶

The German air industry found the 1920s extremely difficult years because of the Treaty restrictions, violent fluctuations of the economy and the chaotic political situation within the Weimar Republic. Many firms active during the war such as Fokker, Pfalz and Gotha folded, while others were disbanded. The few remaining had to develop branch offices abroad, diversify their production, or establish small airlines to use their products. All were reduced to a fraction of their former size: the Junkers firms, for example, employed 2,000 in 1918, but by 1921 had less than 200 employees.⁷ Despite the strenuous and often ingenious efforts of the industry and government, all the firms teetered on the brink of bankruptcy during the 1920s.

But under the watchful, frugal guidance of the Transportation and Defence Ministries some progress was made in those years. By 1926 the unprofitable competition between the many airlines

was solved with the founding of the Deutsche Lufthansa, which placed German commercial aviation on a firm national basis.⁸ In the same year, the Defence Ministry established a dummy civilian corporation called *Fertigungs-GmbH* (Production Ltd.), which was charged with the responsibility of preparing the air industry for mass production in the event of an emergency by promoting uniformity and standardisation within the industry.⁹ By 1928 the first prototypes of four basic types of military aircraft were developed for release to the industry, but the Defence Ministry found that the eight airframe firms were incapable of series production without a massive infusion of money.¹⁰

The situation in the aircraft-engine sector was equally bleak. The four engine firms of Junkers, Bavarian Motor, Argus and Siemens were producing mostly foreign engines under licence in Germany, and the two leading producers during the First World War, Daimler and Benz-Werke, had given up production entirely until 1926. A combination of Allied restrictions, a chronic shortage of public funds and an unfavourable level of business activity had seriously debilitated the pace of engine development. When the depression struck, the two leading engine plants, Junkers and Bavarian Motor, fell into serious financial difficulties, requiring extensive reorganisation before they could survive. Although the Reich government spent 175,032,958 RM subsidising aviation from 1929 to 1932, only 21,105,008 RM was allotted for new development. The lion's share of the subsidy was taken by Lufthansa.¹¹ By 1932 the Defence Ministry estimated that, after the activation of its mobilisation plan, it would take six months to gear up the engine plants to a monthly production of 160 engines, providing the plants could double their work staffs and secure the necessary raw materials, and nearly nine months for the airframe plants to achieve a maximum output of 100 single-engine aircraft monthly.¹²

By the time Hitler took power in January 1933 the conditions of the air industry could best be described as catastrophic. Employment had shrunk to an all-time low of 3,200, and annual output was 33 aircraft. Only the government could save the industry. Ironically, within the Reichswehr, where both the army and navy had fought among themselves for independent air units, the process of centralisation of military aviation was completed a few days after the Nazis took power. In April 1933 the new Nazi government completed the process by establishing a Reich Aviation Ministry (*Reichsluftfahrtministerium*, or RLM) which assumed control over military as well as civilian aviation.¹³

The Nazi movement, a youthful one, had grown up in the air age. Among the top leaders there were a number of fliers, including party secretary Rudolf Hess and, of course, Hermann Goering, last commander of Richthofen's Jagdgeschwader 1. Hitler too had a lively interest in aviation, for he was the first German politician to use the aeroplane extensively in his campaigns.¹⁴ Although the Nazis had no carefully thought-out air power strategy they were committed to a national policy of rearmament, and they were shrewd judges of the psychological impact air power might have on their fellow Europeans. In May 1933 the air theorist Dr Robert Knauss suggested to Erhard Milch, Goering's second in command, the development of a 'risk' fleet of heavy bombers to shield the Reich until the army and navy could be rebuilt. For 80 million RM, or roughly what it would cost to equip five divisions or build two battleships, the Reich could build a fleet of 400 transport bombers that would effectively deter any enemy from interfering with Germany's rearmament.¹⁵ Hitler and Goering accepted the ideas in their own eclectic fashion. They wanted the psychological effect and diplomatic punch of a strategic air force, but, bowing to the more sober advice of the military counsellors who wanted a tactical air force, they chose to build a 'risk fleet' that appeared like a strategic force abroad while it functioned as a tactical one at home. As Goering commented on 1 August 1939, 'At that time we possessed only limited means but we did have enough to build a risk fleet which could insure further rearmament build-up and prepare the way for the Fuehrer to proclaim the resumption of the universal draft.'¹⁶

Under the energetic prodding of Goering and Milch, and with the support of a group of crack officers transferred from the army such as Hans-Juergen Stumpff, Wilhelm Wimmer, Albert Kesselring and Walther Wever, the Nazi government began laying the foundations for a powerful air force and air industry. By 1936 the small and insignificant air industry had grown from employment of 3,200 to 124,878, surpassing the automobile industry's 118,148, with an increase of its net production, valued at 37.5 million RM, to 527 million, or a fifteen-fold increase.¹⁷ Like its counterparts elsewhere, the air industry was completely dependent on public spending. Despite the pious pleading of the Nazis about maintaining private ownership, the air industry was controlled, directed and financed by the government to a degree unparalleled by any other major German industry.

Starting with the '1,000 Plane Programme' of 1933, Goering

and Milch improvised comprehensive production plans designed to tool-up the industry for future production. Schedules, budgets, and model selections were altered to fit the rapidly developing capability of the industry. Aircraft selected for production were determined by what could be produced, since the Reich needed an instant air force. The RLM was willing to write off the first years' production of inferior aircraft to get the process going.

Building on the experiences of the German business community as a whole, the RLM pushed the doctrine of rationalisation in the air industry. In the broadest sense this meant the systematic planning, co-ordination and integration of the entire industry, including standardisation of work procedures, plans and parts, organising joint scientific research, patent-pooling, scientific management and uniform methods of financing and accounting. Competition was discarded and co-operation stressed. A characteristic feature of the industry was the development of a system of complexes built around the few competent engineering and design firms. The parent firm of the complex would control the manufacturing methods and engineering design, maintain quality control and supply basic tools and jigs, and even supplied raw materials.¹⁸ The several licensees within the complex might produce parts, subassemblies, or whole aircraft under the supervision of the parent firm. With a minimum of engineering talent the RLM sought to maximise production in the subcontracting plants of the complex.

By January 1934 a new 'Rhineland Programme', production plan was implemented to run through 30 September 1935. The programme, which called for the production of 4,021 planes, was a compromise between the strategic air-power advocates and the tactical developers of the Luftwaffe. A large number of bombers, 822, compared to only 245 fighters, emphasised the deterrent aspect of the programme, while the 1,760 trainers reflected the thinking of the tactical group.¹⁹ Production forecasts for the programme projected a monthly average rise from 72 aircraft in January 1934 to a high of 293 by July 1935. The monthly average of 265 aircraft for 1935 can be compared with the average of 164 for 1934 and 31 for 1933. Engine production was to experience a similar sharp rise, from an average of 106 in January 1934 to a peak of 704 by July 1935.²⁰ Total employment was to grow in the industry from 16,000 in January 1934 to an estimated 70,000 by midsummer 1935.

In the twelve years of the Third Reich the RLM issued 36

complete industrial production plans, an unbelievable average of three a year. These many changes in the basic planning programme spelled delays, frustrations and lower production in an industry noted for its long lead-time (normally four to five years), the rapid rate of obsolescence of equipment, the uncertainties of new models and unpredictable vagaries associated with production. In the pre-think-tank times of the 1930s, even the best minds of the Third Reich found the analysing and projections involved with aviation planning a fascinating but elusive task, strewn with unforeseen difficulties.

On 10 March 1935 Goering publicly announced the existence of the Luftwaffe, and a few days later Hitler introduced conscription, while he proclaimed his intention of building an army of 36 divisions. Neither announcement occasioned surprise among informed observers; but the diplomatic response was anger confined to verbal protests. The Luftwaffe of March 1935 was not as formidable as the Nazis would have had the outside world believe. The training of units had barely begun, but 2,500 aircraft had been delivered and 800 were operationally ready.

Within the air industry the years 1935 and 1936 were quiet ones, but filled with momentous changes. After the initial rise in production, output levelled out at around 5,500 aircraft, and remained there until the crash programme of 1939, while the relationship between the RLM and the industry underwent fundamental alterations.²¹ The air programme, previously largely uncoordinated and free-wheeling, was more closely integrated into the total armament programme. Competition between the services became sharper, money tighter, raw materials and production facilities scarcer. Important personnel changes were made which shifted the direction and nature of the air industry. In the crucial area of aircraft-model selection and aerial strategy vital decisions were made that materially affected the outcome of the Second World War.

The original team of leaders Goering had gathered around him, that had worked so effectively during the first years of rearmament, found themselves undergoing considerable strain by 1936. The flagging interest of Goering in Luftwaffe matters and the growing ambitions of Milch combined with the untimely death of Wever meant the end of harmonious co-operation at the top echelon of leadership. Goering's relationship to Milch soured, while Milch began intriguing against the professional soldiers and the newly appointed Chief of the Technical Office, Ernst Udet.²²

The production programmes began running into unpredictable snags. Developmental problems with the first generation of warplanes, such as the Bf 109, Ju 86, He 111 and Do 17, growing political pressure by Hitler and Goering for an increase in the tempo of rearmaments, and difficult raw materials and technological problems within the industry meant a constant juggling of production programmes. Compromises were inevitable, and the results were lower production, premature forcing of prototypes, prolongation of older models and enormous strain on the jangled nerves of everyone involved.²³

These were crucial years in model selection and the development of an air strategy. The standard combat aircraft that Germany used in the Second World War were designed and accepted for production, including the light fighter, the Bf 109; the heavy fighter, Bf 110; the medium bombers, the He 111 and Do 17; and the dive-bomber, the Ju 87. The first four-engine heavy-bomber prototypes, the Do 19 and the Ju 89, were built; but already the Luftwaffe was committed to a tactical air-force concept. The decision to defer work on a heavy bomber to a later time was understandable given the circumstances. The Luftwaffe was confronted with budgetary restrictions, raw-materials shortages, poor results with level bombing by its training wings, slow engine-development, limited production facilities, the phasing-in of new models into series production, and the pervasive view among the military that they needed a tactical air force to fight a limited European war. All of this added up to the obvious conclusion that Germany could not risk tying up so much of her limited resources in an ambitious programme of heavy bombers in the mid-1930s. The Luftwaffe would gamble on first building a tactical air force around her dive- and medium-bombers and then, later, in the late 1930s or early 1940s, cap off this force with a strategic bombing force built around a much more advanced heavy bomber.²⁴ The results of the deployment of new German aircraft in the Spanish Civil War soon seemed to vindicate this line of thinking.²⁵ German successes with dive-bombers and the fast, unescorted twin-engine bombers were impressive, and added weight to the arguments within the Luftwaffe that a strong tactical air force was enough for its intended mission.

German aircraft-production programmes from January 1937 until the Munich crisis of September 1938 suffered a series of convulsive jolts caused by raw materials and budgetary difficulties, phasing-in of new aircraft models as they developed, and the erratic demands of the German leadership. Planning

Table German aircraft production 1931-9 - two estimates

Year	USSBS estimate			Hertel's estimate ¹	
	Combat aircraft type	Others	Total	Total	+ or - over previous year
1931	0	13	13	-	-
1932	0	36	36	-	-
1933	0	368	368	-	-
1934	840	1,128	1,968	1,817	-
1935	1,823	1,360	3,183	3,307	+1,490
1936	2,530	2,582	5,112	5,248	+1,941
1937	2,651	2,955	5,606	5,749	+ 501
1938	3,350	1,885	5,235	5,316	- 433
1939	4,733	3,562	8,295	7,582	+2,266

Sources: Walter Hertel, *Die Flugzeugbeschaffung in der Deutschen Luftwaffe*, Studiengruppe Geschichte des Luftkrieges, No. 170, Maxwell Air Force Base, 1955, p. 289, and USSBS, Overall Report (European War), 30 September 1945, p. 11.

¹ Hertel's figures apparently do not include production of aircraft from Bohemia-Moravia, but do include Austria, while those of the USSBS include all these areas. All figures for 1939 include aircraft produced up to Sep. 1.

prior to 1937 had anticipated a steady increase in production over the next two years, but actual figures indicated a levelling-off in 1936 to 1938 (see Table).

In part the levelling-off of production was caused by factors outside the Luftwaffe's realm of effective control. World prices for raw materials rose sharply from their depression levels at precisely the time that Germany's demands, stimulated by rearmament, were also rising. German exporters were unable to keep pace by expanding their sales abroad to gain the needed foreign exchange necessary to purchase raw materials. A 'bread crisis' in the winter of 1935-6 which necessitated larger imports of foodstuffs, particularly fats, placed an additional strain on Germany's foreign-exchange problem. Hitler's solution was the Four Year Plan of 1936, which aimed at husbanding Germany's dwindling resources of foreign exchange by reducing dependency on foreign raw materials through the development of substitutes such as synthetic oil, rubber and textiles. Rather than reduce the pace of rearmament, Germany was prepared to fight the 'battle of raw materials' until such time as she could solve her economic problems by conquest.²⁶

For the air industry the shortages of aluminium, iron, steel, cement and wood meant curtailing plant-expansion and deferral of capital-equipment purchases. By the summer of 1937, shortages caused lay-offs in the industry, and by October Milch reported that overall Luftwaffe production in aircraft would be reduced by 25 per cent, industrial construction by 66 per cent, flak by 75 per cent and civil defence by 100 per cent.²⁷ Budgetary cut-backs were also instituted especially in the fiscal year 1937/8. A large billion-RM slash in the RLM planned budget of 5.4 billion hit hardest the aircraft-procurement and the aircraft-repairs and spare-parts division. Wherever possible, sacrifices were made to protect the output of combat aircraft, but the deleterious effects of the cut-backs would be felt for years.²⁸

Despite the shortages in materials and money, some of the blame for the low level of production must be given to the masters of the Third Reich, for they were neither able to fashion a priority system for what they wanted nor to design a comprehensive programme to control and disburse their limited economic resources. The allocation of raw materials was never systemised until late in the Second World War, while the political leaders and General Staff of the Luftwaffe continued to press demands on the industry that were beyond its capability. As a result the Air Ministry was continually changing its programmes. From January 1937 to September 1938 the RLM had five major production plans in effect. Their major thrust was to introduce new aircraft-model changes while scaling down total production to meet the bottlenecks in raw materials and money. Although the levelling-off of aircraft production from 1936 to 1938 does not appear too great in actual production figures, the potential loss to Germany was far greater.

Walter Hertel, a ranking official in the RLM, writing after the war, claims that, had the original production plans been followed, some 6,226 aircraft would have been produced in 1937; but the billion-RM slash of 1937/8 so affected production expansion that Germany lost nearly a year regaining its rearming momentum. He further estimates that had the normal expansion in the industry occurred, production in 1939 would have reached the 1941 average of 1,200 aircraft a month.²⁹

Four years after the Nazis seized power the major characteristics of the aviation world of the Third Reich were already evident. The prejudicial exercise of political influences in the three areas of personnel, selection of aircraft and production programmes boded ill for the future. Some of this could have

been reduced had Hitler and his General Staff been more frank and explicit in the formulation of their strategic and tactical requirements, or had the technical experts within the Air Ministry been more resolute in their judgements and more skilful in their administration. But under the urgent pressure of time and the acute shortages of strong, independent technical experts, particularly in the selection and planning of aircraft, an acceptance of political decision-making was being conditioned into the Luftwaffe. The instant decisions made by the political leaders, often without sufficient consultation and largely based on the spurious doctrine of the *Führerprinzip*, eroded what little detached and critical thinking that had developed in the still very young and malleable Luftwaffe. Particularly unfortunate for the Luftwaffe was the loss in 1936 of the steady hand of General Wever, who might well have been able to obviate some of the personnel feuds and reduce the growing political influences within the air force.

By the time of the Munich crisis the Luftwaffe had successfully made the metamorphosis from a risk fleet designed to intimidate Germany's neighbours sufficiently long for her to rearm to a deadly instrument of political blackmail for Hitler. The process from 'risk' fleet to political blackmailer was a short one; especially since the air theorists, writers and artists of the 1930s had developed a veritable cult around the terrors of future air wars. Adroitly playing on the fears of his neighbours, Hitler made the best of his air-power advantage.

Behind this powerful Luftwaffe stood the German air industry. By 1938 the industry largely conformed in size and potential to what the German planners had projected it would be in 1933-4. A well-dispersed, lavishly constructed industry, it enjoyed considerable advantages over its European counterparts. Under the guidance of its powerful patron Goering, the industry had a system of factory complexes which ensured that every single major German aircraft with the exception of the Ju 87 and every major type of engine could be produced in one or more back-up plants. Still working on a single-shift eight-hour day, the factories had large unused capacities that could be readily tapped in the event of full mobilisation. By August of 1938, the industry had been given the green light by Goering to 'freeze models and mass-produce'.³⁰ Gone were the hesitations of the past; money flowed in; expansion was reinstituted; production accelerated. Given the inertia in any large industry however, it was not until May 1939 that actual aircraft production

reached the level it had been at in March 1937.

The aircraft-engine plants had also made rapid progress in catching-up the time they lost in the 1920s. By 1937, the wholly German-designed 20-litre class (1,000 hp and above) DB 600 and Junkers Jumo 211 series were ready for mass production. Both engines were on a par with the best foreign engines then in existence, as the results of the international air shows and the war in Spain clearly indicated.

By October 1938 the German air industry was one of the largest in the country, employing 293,000, with 146,263 in the airframe division and 57,749 in the engine division, and with the remainder in the equipment and repairs divisions.³¹ Although the engine division was dominated by three firms (Junkers, BMW, Daimler-Benz), the airframe division was nicely balanced with eighteen firms. On the surface all seemed placid in the air industry, but underneath everything was in turmoil. The industry was seething with resentment towards the Air Ministry for its fiscal, managerial and technological incompetence, while the unbridled egoism of the firms precluded any real co-operation with the RLM or within the industry. The annual RLM summer conferences were bitter affairs, where the vanity, egoism and naked business interests of the designers and their firms were scarcely concealed by common courtesy. Charges and counter-charges were volleyed back and forth, as each blamed the other or the RLM for shortcomings and errors.³² Personal influence, intrigues and pettiness characterised relations within the industry. Personal feuds between Goering and Milch, Milch and Udet, and the professional soldiers and the civilians handicapped the RLM's handling of the firms, while the owners of the firms rarely missed an opportunity to use every feud and every ounce of political influence, from Hitler to the local Gauleiter, to gain some small margin of advantage over the others.

Starting with the huge Ju 88 programme in the autumn of 1938 and continuing until the first bomb dropped on Poland, the RLM rushed the industry to war. Scarcely two weeks after Munich, Hitler ordered a gigantic fivefold immediate increase in the Luftwaffe.³³ The Führer's programme was utterly beyond the capacity of the industry, especially considering that three key models to be mass-produced, the Ju 88, He 177 and Me 210, were still in the testing and developmental stage. Moreover, the skilled labour for the firms, additional construction workers for expansion, machine tools, building materials, money and the foreign exchange needed were simply not available. For example,

the Technical Office estimated that the fuel supply for Hitler's intended Luftwaffe would require importing 85 per cent of the world's existing production of aviation fuel!³⁴ The cost of such a programme was projected at a staggering 60 billion RM, or almost the same amount as was spent from 1933 to 1939 for all military preparations. Despite these seemingly insurmountable obstacles, Goering, Udet and the new young Chief of Staff Hans Jeschonnek committed the Luftwaffe to meeting the Hitler programme. No one will ever know to what extent Hitler's assessment of his air-power advantage influenced his decision to go to war, but it is clear that he counted heavily on the Luftwaffe's giving him the decisive edge on French land and British naval power.

In conclusion, it can be seen that the pattern of German aircraft production in the inter-war period followed rather closely the pattern Higham detected in the British air industry; that of protraction, doldrums, then gradual, and then rapid rearmament.³⁵ The difference was that during the 1920s the pattern was imposed from outside forces, whereas Germany caught up with the more advanced technological aviation nations easily and rapidly in the 1930s. In part this catch-up can be attributed to the traditional German virtues of industry and precision, but in part it is attributable to the fact that the first upswing in German aerial rearmament coincided with a major technological breakthrough in aerodynamic design and production. Two innovations, the variable-pitch propeller and the split flap, which greatly improved performance and control, combined with a better understanding of the influence of drag on design of high speed aircraft meant that an era of design associated with the First World War was over and a new era was about to begin. Without pushing the analogy too far, it might be argued that German aerial rearmament was analogous to the introduction of the dreadnought in the Anglo-German naval race before 1914. Technological innovations made both sides start afresh. The effect was to nullify the advantage of a large weapon inventory of one side while encouraging the other side to gain the drop on the other. In the broadest sense, that is what German air power did for Hitler. It gave him the drop on his neighbours, an advantage he exploited ruthlessly, but an advantage that was soon gone.

Notes

1. Morrow, John Howard, 'The Prussian Army and the Aircraft Industry, 1909-1914', *Aerospace Historian*, 20, 2, June 1973, pp. 76-83; for the war see General der Kavallerie Ernst von Hoeppner, *Deutschlands Krieg in der Luft*, Leipzig, 1921. Production and aircraft figures are from Werner Schwipps, *Kleine Geschichte der deutschen Luftfahrt*, Berlin, 1968, pp. 69-71, 76-7; Hauptmann Hermann [pseud.], *The Luftwaffe: Its Rise and Fall*, New York, 1943, pp. 55-6; and J. A. Gilles, *Flugmotoren 1910 bis 1918*, Frankfurt, 1971, pp. 123-4.
2. The figures for war materials turned over to the Allies or destroyed vary considerably. Heinz Orlovius and Ernst Schultze (eds), *Die Weltgeltung der deutschen Luftfahrt*, Stuttgart, 1938, pp. 9-10, claim 14,000 aircraft and 28,000 engines; F. Ganderberger von Moisy, *Luftkrieg - Zukunftskrieg?*, Berlin, 1935, pp. 39-40, mentioned 14,014 aircraft, 27,757 engines and 2,500 anti-aircraft artillery; Otto Gessler, *Reichswehrpolitik in der Weimarer Zeit*, Stuttgart, 1958, p. 226, 14,000 and 27,000; Hans Guhr, *Sieben Jahre interalliierte Militärkontrolle*, Breslau, 1927, p. 15, 14,014 and 27,757; Peter Supf, *Das Buch der Deutschen Fluggeschichte*, Vol. II, Berlin, 1935, p. 226, 15,714 and 27,757. Gilles, *Flugmotoren*, p. 123, claims 27,160 engines were destroyed and 2,600 delivered to the Allies.
3. Karl-Heinz Völker, *Die Entwicklung der militärischen Luftfahrt in Deutschland 1920-1933* (Beiträge zur Militär- und Kriegsgeschichte, Vol. 3), Stuttgart, 1962, pp. 129-30; Richard Suchenwirth, *The Development of the German Air Force, 1919-1939*, USAF Historical Studies, No. 160, Maxwell Air Force Base, Ala. 1968, pp. 7-8.
4. Karl-Heinz Völker, *Die Entwicklung der militärischen Luftfahrt in Deutschland 1920-1933*, p. 130; Schwipps, *Kleine Geschichte der deutschen Luftfahrt*, p. 83.
5. Suchenwirth, *The Development of the German Air Force, 1919-1939*, pp. 14-15; Hermann, *Luftwaffe*, pp. 61-3; Robin Higham, *Britain's Imperial Air Routes, 1918-1939: The Story of Britain's Overseas Airlines*, London, 1968, pp. 88-91.
6. General information on the Russian bases can be seen in General der Flieger a.D. Hellmuth Felmy, 'Luftfahrt Ausbildung in der Reichswehr', Teil I, B/II/b; Generalleutnant a.D. Bruno Maass, 'Organisation der Fliegerstellen im RWM 1920-1933', A/II/2 and General der Flieger a.D. Wilhelm Wimmer, 'Stellungnahme zu Luftfahrt-Ausbildung in der Reichswehr von Hellmuth Felmy', Teil I, B/III/1a, all in the Karlsruhe Document Collection, Maxwell AFB, henceforth cited as KDC/M.
7. Karlheinz Kers and Heinz J. Nowarra, *Die deutschen Flugzeuge, 1933-1945*, Munich, 1964, p. 338; Hermann, *Luftwaffe*, pp. 30-1, 68-78.
8. Völker, *Luftfahrt in Deutschland*, pp. 152-3 and R. E. G. Davies, *A History of the World's Airlines*, New York, 1964, pp. 20-6.
9. Information on activities of the *Fertigungs-GmbH* is from 'Die Deutsche Luftwaffenindustrie vor und während des Krieges', National Archives Microcopy T-971/27/377-80 and 'Beitrag für eine kriegsgeschichtliche Studie der Beschaffung von Luftwaffengeräten', Lw 103/66, in Dokumentenzentrale des Militärgeschichtlichen Forschungsamtes, Freiburg, henceforth cited as DZ/MGFA.
10. Walter Hertel, 'Die Flugzeugbeschaffung in der Deutschen Luftwaffe', No. 170 Studiengruppe Geschichte des Luftkrieges, KDC/M, pp. 8-13;

- Generalingenieur a.D. Gerbert Huebner, 'Der tatsächliche Ablauf der Aufgabenstellung und Auswahl der Flugzeuge für die deutsche Luftwaffe', dated 1956, KDC/M.
11. Adolf Bäumer, 'Zur Geschichte der Luftfahrtforschung', Lw 103/61, DZ/MGFA. W. M. Knight Patterson [pseud., =Władysław Wszebór Kulski], *Germany from Defeat to Conquest*, London, 1945, p. 405 and Georges Castellan, *Le Réarmement Clandestin du Reich, 1930-1935*, Paris, 1954, p. 146, cite approximately the same figure.
 12. 'Die augenblickliche Lage der deutschen Luftfahrtindustrie'. In 1 Nr 832/32 In 1 III g.Kdos., dated 31 March 1932, DZ/MGFA.
 13. Der Reichsverteidigungsminister und Befehlshaber der gesamten Wehrmacht, LA Nr. 617/33 geh.Kdos. L 1 (H) II A, Berlin, den 18 May 1933, in DZ/MGFA; Völker, *Luftfahrt in Deutschland*, pp. 276-8.
 14. 'Eine Rechtfertigung für die Niederlage und die Fehler der Luftwaffe, von G.F.M. Milch', von Rohden document (4376-2112), Bundesarchiv-Militärarchiv, Freiburg (henceforth cited as BA-MA); Konrad Heiden, *Der Fuehrer*, Boston, 1944, pp. 444-53; Martin Broszat, *Der Staat Hitlers*, 3rd edn, Munich, 1973 DTV (Deutscher Taschenbuch Verlag)-Weltgeschichte des 20. Jahrhunderts, Vol. 9, pp. 44-5. See also the opening sequence of the masterful propaganda film of the Nuremberg party rally of 1934, 'The Triumph of the Will' by Leni Riefenstahl, which shows Hitler's plane majestically flying out of the clouds to arrive at the medieval town.
 15. Bernhard Heimann and Joachim Schunke, 'Eine geheime Denkschrift zur Luftkriegskonzeption Hitler-Deutschlands vom Mai 1933', *Zeitschrift für Militärgeschichte*, 3, 1964, pp. 72-86; Gerhard Förster, *Totaler Krieg und Blitzkrieg, Die Theorie des Totalen Krieges und des Blitzkrieges in der Militärdoctrin des Faschistischen Deutschlands am Vorabend des Zweiten Weltkrieges*, Berlin, 1967, pp. 150-3. Milch later claimed he originated the 'risk fleet' idea; David Irving, *Die Tragödie der Deutschen Luftwaffe, Aus den Akten und Erinnerungen von Feldmarschall Milch*, Berlin, 1970, pp. 63-4, 67, 403.
 16. Von Rohden, NA Microcopy T-971 /27/905; Generalleutnant Andreas Nielsen, *The German Air Force General Staff*, USAF Historical Studies, No. 173, Maxwell Air Force Base, Ala., June 1959, p. 17. See also the statement of George S. Messersmith, US Consul General in Berlin, in *Nazi Conspiracy and Aggression* (Nuremberg, 1947-9), Vol. V, p. 25, when he commented that the Nazis decided to concentrate on air power as a '... weapon of terror most likely to give Germany a dominant position and the weapon which could be developed the most rapidly and in the shortest time'.
 17. Statistisches Reichsamt, Abt. VII Industrielle Produktionsstatistik, A. die Flugzeugindustrie 1933-36, NA Microcopy T-177/32/3720917-20.
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 19. Flugzeugbeschaffungsprogramm vom 1 July 1934. Akte L II 1926 and LA/LC Nr. 280/39 g. Kdos. AII 2A, Flugzeugbeschaffungsprogramm für den 1. und 2. Aufstellungsabschnitt, 19. Jan. 1934, Lw 103/69, both in DZ/MGFA. See

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20. RLM LC III, Monatliche Motorenausbringung vom 1. Jan. 1934 bis 31. Juli 1935, Lw 103/6, DZ/MGFA.
21. Ibid.
22. Richard Suchenwirth, *Command and Leadership in the German Air Force*, USAF Historical Studies, No. 174, Maxwell Air Force Base, Ala., July 1969, pp. 25-31, 148-52. See also the interviews of Generaloberst a.D. Bruno Lörzer, 26 Jan. 1955; Generalmajor a.D. Dip. Ing. August Ploch, 7 March 1955; and Col. Max Pendele, 3 Sept. 1955, D/II/1, KDC/M.
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7

The Development of Defensive Armament for US Army Bombers, 1918–1941: A Study in Doctrinal Failure and Production Success

Irving B. Holley, jun.

The experience of the Air Service of the American Expeditionary Force, the AEF, in the First World War offers some informing insights on the complex problems of bomber self-defence in the Second World War. Unfortunately, the US Army Air Service of the First World War era lacked a truly effective system for gathering and exploiting technical intelligence, and in consequence many well-articulated lessons from the hard-won experience of the First World War were largely ignored after the Armistice. This pattern of behaviour had been prefigured during the war, when the US Army placed orders for large numbers of flexible gun-mounts which a manufacturer in the United States produced in a remarkably short time. When the gun-mounts arrived in France, however, they were found to be obsolete models fashioned after designs abandoned by Allied airmen as inadequate. So the American product had to be scrapped and replaced with suitable French equipment.¹

The cautionary tale related here should be obvious. The productive capacity of the United States was superb, but the Army's procedures for defining and updating requirements were largely undeveloped. Rushing into production before thinking the problem through has its drawbacks. The episode reminds one of the impetuous old general who was known to his troops as 'Ready! FIRE! Aim!'

The experience of the Air Service in France had clearly identified

I am indebted to my colleague Professor Alex Roland for constructive criticism of an initial draft of this paper.

what the major unsolved problems of flexible gunnery were. Four stood out above all others. The ever-higher speeds of modern aircraft were making precision tracking by manual operation of machine-guns in flexible mounts almost impossible. By the end of the war it was evident that some kind of powered operation was imperative if gunners were to achieve any degree of accuracy when beset by the adverse effect of slipstream.² Further, operations in France had indicated that the standard calibre 0.30 machine-guns used by the Air Service were far too light to have the destructive impact required to bring down an enemy plane with a few hits. Obviously a heavier gun would have to be developed; but a larger gun would only aggravate the problem of slipstream on the gun-barrel.³

Wartime experience had also shown that most successful attacks on bombers came in the region behind the tail, so some means had to be found to provide aimed fire-power to cover this vulnerable area, which was normally masked by the bomber's tail structure. Even if powered mounts could be developed for heavier guns covering the tail, still to be solved was the inordinately difficult task of aiming or sighting. This involved finding and identifying a rapidly approaching enemy interceptor anywhere in the gunner's whole field of vision, tracking the target smoothly, and then estimating range and appropriate lead before firing. Manifestly, finding solutions for these problems called for a high level of scientific expertise and creative imagination.

The Army Ordnance Department did heed the call for a heavier machine-gun, and by the early 1920s produced an excellent calibre 0.50 Browning of high reliability. But these guns were almost never installed. Since more training could be accomplished for a given amount of money using the smaller-calibre 0.30 guns, the Air Service continued to use these throughout the inter-war years.⁴ While the need for economy was beyond dispute, no provision was made in designing the flexible gun-positions on bombers to take the heavier-calibre guns in wartime, although this was done for the fixed guns in fighter aircraft.⁵

The problem of overcoming the effects of slipstream by the use of powered gun-drives suffered from a similar neglect in the Army air arm. Although a number of inventors and designers came to the Army with patented schemes for using powered gun-mounts, none of these received more than fleeting attention from the military authorities in the 1920s.

Indeed, even the principal Air Service armament officer appears to have forgotten the experience of the war years when, in 1923, he rejected a proffered design with the comment, 'It is power-driven, which seems unnecessary in a device to carry machine-guns for defensive purposes.'⁶ By the end of the 1920s armament officials were at least willing to consider power drives, but still expressed a generally dubious view, pointing out that such devices would necessarily be slow, and thus tend to inhibit the gunner's ability to switch from one target to another.⁷

In Europe, however, where the urgency was greater, experiment progressed steadily, and by the middle 1930s the concept of power-operated turrets had actually been pushed beyond experiment to the stage of production in quantity. The Italians, for example, after experimenting with electric drives, had developed a hydraulic system, which gave smoother tracking, for installation in the Fiat BR-20 bomber.⁸ In Britain the Air Ministry had gone even further, working with three different manufacturers to explore various alternatives. One of these, Boulton-Paul, after trying an unsatisfactory compressed-air drive, switched to a hydraulic system which allowed the gunner to track smoothly at variable speeds proportionate to the degree of displacement of his control handles. This was a crucial conceptual contribution to effective tracking. Another British conceptual breakthrough was the notion of rotating the seated gunner with the turret so that he remained aligned with his gun-sight, and could scan the hostile skies for long periods with minimal fatigue.⁹

The British not only developed efficient power-turret designs, but as early as 1936 specified their use on the next bomber put into production. This was the Avro Manchester, which mounted a two-gun nose-turret, a two-gun dorsal turret, and a four-gun tail-turret, establishing a configuration which virtually all RAF heavy bombers in the Second World War were to follow.¹⁰ That the British fully appreciated the high probability of attacks in the tail-cone area is evident in the decision to mount four guns rather than two aft of the Manchester's empennage.

The contrast between the impressive development of bomber armament in Britain and the laggard pace in the United States was rather pointedly revealed in 1937 when the RAF offered to negotiate a mutually advantageous exchange of technical information on bomber defence. Unfortunately, the best quid pro quo the US Army Air Corps could offer was a set of blueprints

for the manually operated plexiglass gun enclosure on the nose of the Martin B-10 twin-engine bomber, an already obsolete design of no interest whatever to the RAF: it represented only a slight improvement over the gun installations of 1918.¹¹

To account for their failure to perfect adequate bomber armament between the wars, air-arm apologists routinely cite the lack of funding. It is certainly true that appropriations were never enough during most of the period, but it is also clear that a number of other factors were involved, and these should not be overlooked. To begin with, many Air Corps officers were persuaded that bombers had little to fear from intercepting fighter aircraft. Despite the fact that experience in the First World War had shown that day bombers without fighter escorts were decidedly vulnerable, during the years of peace this vital lesson was increasingly neglected. With the appearance of all-metal monocoque aircraft having markedly improved power-plants, multi-engine bombers began to outstrip the fastest fighters then available. This led bomber enthusiast Lieutenant-Colonel H. H. Arnold, who then commanded one of the major General Headquarters Air Force strategic bomber units to conclude: 'Pursuit or fighter aircraft . . . will rarely intercept modern bombers except accidentally.' Nor was this an isolated opinion.¹²

The principal Air Corps spokesman testifying before Congress during the appropriation hearings in 1937 observed that pursuit aircraft, for want of adequate range, could no longer escort bombers all the way to their targets. Then, because the currently 'available pursuit aircraft were unable to accompany bombers all the way, he went on to make the unwarranted inference that 'large numbers of pursuit airplanes' were 'no longer so vitally necessary as before'.¹³ Clearly, this was a ploy to induce Congress to appropriate more money to bombers than to pursuits. But such testimony, however dubious its validity, once laid out on the official record, showed a distressing tendency toward becoming official fact.

When an Army intelligence analyst commenting on the Sino-Japanese war in 1938 suggested that the Japanese had accepted the American belief that bombers were invincible and had been badly mauled by Chinese fighters as a result, an official at Wright Field, the Air Corps research and development centre, denied any official sanction for the idea of bomber 'invincibility'. But, having said that, he went on to assert that bomber formations of proper strength, disposition, training and armament could operate effectively over enemy territory without ac-

companying escort fighters.¹⁴ For the officers in the Armament Laboratory at Wright Field, determining precisely what constituted 'proper armament' for bombers was the pressing problem of the day; regrettably it was one on which they had made scant progress.

The armament staff at Wright Field often complained of the difficulty they encountered in eliciting constructive suggestions about defensive fire-power from the men who flew as bomber crews in the operational units. Some of this stemmed from the pervasive preoccupation of Air Corps officers with flying: since armament officers in tactical units were required to be pilots, their interest in flying almost invariably took precedence. But there were other reasons as well why flexible gunnery tended to be neglected in the peacetime years. Most of the air bases in the United States lacked adequate firing ranges where crews could practice with live ammunition on those limited occasions when funds were authorised to expend it. This, coupled with the fact that gunners were enlisted men with other crew duties, such as as radio operators or mechanics, functioned to dampen interest in the development of improved bomber armament.¹⁵

Not surprisingly, the problem of defensive armament during the inter-war years seldom attracted the abler officers of the service. As an air arm Tactical School publication once put it with unusual bluntness, an individual was designated as an armament officer 'chiefly because there is nothing else he can do'.¹⁶ Even if untrue, this comment suggests a commonly held attitude. Under the circumstances it was scarcely to be expected that the tactical units would offer many constructive suggestions to the Armament Laboratory. Even when occasionally an officer did show an interest in the subject, he found the path rocky.

When a concerned officer wrote an article for submission to a professional journal on the glaring deficiencies in bomber defences, pointing to the lack of progress in the decade following the Armistice and the need for creative ideas to remedy the neglect, he was denied permission to publish. The reason given was that his piece would be poor publicity for the air arm.¹⁷ Manifestly, those ultimately responsible for perfecting viable, survivable bombers had little or no appreciation for the dialectical process by which problems are raised and various possible solutions are elicited, and then discussed objectively to winnow out the most promising. It was precisely this kind of self-inflicted wound, no less than the lack of funds usually cited,

which seriously retarded the improvement of bomber armament between the two world wars.

Occasionally an imaginative officer would rise above the many existing inhibitions and undertake an experiment to test the adequacy of existing armament arrangements. In one such, an obsolescent P-36 fighter was directed to attack a B-10 bomber head-on, nose to nose, along a predetermined ground course, to test the feasibility of nose attacks. The fighter pilot subsequently reported that his tactic was of marginal utility, since he barely had time enough after identifying the on-coming bomber to avoid a collision.¹⁸ Courageous Luftwaffe pilots later demonstrated just how wrong this conclusion was when they repeatedly employed head-on nose attacks in their efforts to break up Allied bomber formations over Germany.

If nose attacks were seen as scarcely feasible, then the obvious inference to be drawn was that defensive armament should be devised to cover the 40° cone behind the tail, where experience in the First World War had suggested that 80 per cent of all fighter attacks could be expected.¹⁹ The crowning irony was the armament of the B-10 bomber, the pride of the Air Corps in the 1930s, which had no gun covering the tail-cone area but did have a gun enclosure in the nose, where few if any attacks were expected. In mitigation it might be argued that the Martin B-10 bomber was designed in 1932, before Air Corps officers were aware of the development in Europe of power-operated turrets or their placement in the tail of a bomber. But this argument falters when we discover that in 1936, to replace the B-10 the Air Corps contracted for the Douglas B-18, which also had no gun in the tail. Its sole armament consisted of three guns, one in the nose, one dorsal and one ventral, all of calibre 0.30, regarded as inadequate back in 1918.²⁰

By the middle of 1939, when murmurs of war in Europe were already audible, reports from the fighting in Spain and in China and the example of the RAF had finally persuaded Air Corps Armament Laboratory officials that multiple-gun power-turrets and fire-power coverage for the tail-cone were essential. But having reached that realisation was a far cry from providing the necessary equipment. The whole long process of experimentation which the British had gone through in the early 1930s was yet to begin in the United States.²¹

Not all the blame for the long delay in developing suitable bomber defences can be assigned to those in charge of the Armament Laboratory. Aircraft manufacturers were almost uni-

versally reluctant to instal protuberances of any kind, whether gun-domes on top or 'bathtubs' slung below to accommodate a gunner firing aft: such projections increased drag, and reduced the maximum obtainable top speed. And high speed was the performance characteristic which carried the most weight in the evaluation of competing aircraft designs submitted by rival manufacturers.

The lack of realism which tintured so much Air Corps thinking during the inter-war years is nowhere more evident than in the complaint of the Chief of the Aircraft Laboratory inveighing against the introduction of turrets with 'prohibitive drag'.²² In the trade-off between speed and adequate armament, he left no doubt as to where his decision would lie.

Although the Armament Laboratory staff clearly had less clout than their colleagues in the Aircraft Laboratory, in the 1937 edition of the *Handbook of Instructions for Airplane Designers* they did at least mention gun-turrets, albeit rather passively as options to be considered in order to provide tracking 'throughout the entire field of fire without undue exertion on the part of the gunner'.²³ Since this set no specification as to what constituted 'undue exertion', designers were left largely free to interpret the requirement as they wished.

The evolution of the Boeing Aircraft Company's B-17, the famous four-engine, long-range strategic bomber, the 'Flying Fortress' of the Air Corps, offers us revealing insights on the prevailing thought in the Armament Laboratory. In 1935, when Boeing first presented its design in response to a circular proposal from the Air Corps, the plans called for five calibre 0.30 guns (in ventral, dorsal, nose and two waist positions) rather than the three positions (ventral, dorsal and nose) specified in the *Handbook*.²⁴ This scheme was criticised by the staff at Wright Field on the grounds that the crew of five, including the two pilots, could not man all the positions simultaneously.²⁵ Boeing ignored these objections and produced the first B-17 with the five hand-held guns as planned. The first production model B-17A, scheduled to begin delivery in 1938, still sported no more than the same five calibre 0.30 guns. When armament officers objected to the restricted fields of fire offered by these guns, Boeing added blisters (B-17B) for the waist guns and a bathtub (B-17C) for the ventral position, only to be told these were aerodynamically unacceptable.²⁶

Remarkably, none of the guns in these successive Boeing designs offered fire-power in the tail-cone area. Indeed, when

Air Corps officers raised this point, Boeing indicated it 'could not possibly put a tail gun on the B-17 since that would require redesigning the whole tail!'²⁷ This was not simply obduracy on the part of the contractor. The prevailing assumption for many years in Air Corps circles had been that weight and balance considerations precluded placing a gunner aft of the tail. Further, it was argued that such a position was not feasible because of the high accelerations to which a gunner stationed there would be subjected.²⁸ The large gap between Air Corps thinking on this subject and what the British were actually doing is difficult to understand.

One aspect of British practice, however, finally did capture the attention of Air Corps armament officers, who were at last convinced that some kind of power-drive for flexible gun-positions was essential. The Douglas Aircraft Company on its own initiative had been experimenting with power-drives, and submitted engineering drawings for hydraulically driven nose and upper turrets for installation on the B-18 as modifications to the existing contract. Armament officers at Wright Field found these proposals promising enough to justify an exploratory contract. Since they had not yet been reduced to practice, however, the production contracts for the B-18 twin-engine bomber, eventually reaching a total of 400 planes, went ahead with the three hand-held calibre 0.30 guns originally specified.²⁹ The Douglas initiative was not all lost motion, however, for it helped educate armament officers at Wright Field in some of the problems to be encountered in developing power-turrets. And not least among the beneficial results of the Douglas effort was the encouragement it gave Vickers, Inc., the manufacturer of hydraulic variable displacement pumps, which subsequently proved to be highly successful in providing smooth tracking for turrets under widely differing loads.³⁰

In a belated attempt to address the problem of tail-cone coverage the Armament Laboratory entered into negotiations with the General Electric Company for the design of a remotely controlled gun to be installed in the tail of the B-18. General Electric had developed controls for the Navy's five-inch deck guns, so the firm had considerable experience with variable-speed drives. But shipboard guns were a far cry from the challenge presented by aircraft. After promising a design in two weeks, GE finally delivered one five months later, which showed how inexperienced its engineers were with the peculiarities of aircraft. They had concocted a scheme whereby the gunner sat

in a dorsal turret which he was to rotate by means of a bicycle-pedal arrangement, sighting past the tail for a gun located below the empennage. Although the company constructed an experimental model of this totally impractical arrangement, by the time it was delivered for testing late in 1939 it had already been overtaken by events.³¹ But, once again, even an abortive experiment had its pay-off. The power-drive used by GE to manipulate the B-18 tailgun introduced the armament staff to the amplidyne unit, an ingenious electric motor which could maintain constant speed under variable loads. It achieved this by controlling the magnetic field of the motor rather than by rheostats on the power-feed, which required maximum power for high torques at low tracking speeds.³²

By one of those ironic twists which seem to abound in history, by 1939 the Chief of the US Army Air Corps was none other than General H. H. 'Hap' Arnold. He, who in 1934 had played down bomber armament in the belief that fighters would rarely be able to intercept bombers, now deplored the lack of progress in bomber defence, and rather ungraciously pinned the blame on his colleagues engaged in research and development at Wright Field. He called for 'drastic steps' to bring gunnery up to a level commensurate with the impressive advances in aircraft performance.³³

The outbreak of war in Europe in September 1939 began to change attitudes in Congress, and made 'drastic steps' somewhat more possible by the promise of an increased flow of appropriated funds. And, no less importantly, the war spurred the armament staff to aggressive action in drawing up statements of requirements and negotiating contracts for experimental multi-gun power-turrets to replace 'the existing manually operated emplacements for single guns', a statement which clearly indicates how painfully far behind the United States was in the race to develop bombers which could defend themselves against interceptors.³⁴

To help close the gap, General Arnold ordered the Air Corps Board, the agency responsible for investigating policy issues, to study the whole problem of bomber defence. The Board's report in January 1940 pointed to the deficiency in existing bomber armament in the aft hemisphere, making it perfectly feasible for an enemy interceptor 'to approach from the rear and attack without detection' - a conclusion that could have been articulated in 1918. Among other remedies, the Board recommended that the Armament Laboratory explore the potential of comput-

ing gun-sights, range-finders and power-drives, all items which the armament staff already had under consideration. This was good if obvious advice, but it should have been given years earlier.³⁵

The sad truth was that, for lack of imagination in studying the problem and defining the tasks to be performed and for want of funds to pursue developmental work during the years of peace, the armament staff had no designs sufficiently beyond the early discussion stage to be put into production to equip the various bombers already beginning to take shape.

The Armament Laboratory staff at Wright Field, at last well aware of the need to make up for lost time, now that funds were expected to be more readily available, decided upon a policy of encouraging several different manufacturers with suitable developmental engineering departments to explore a variety of solutions to the problems of turret design. To simplify matters they assigned each such firm to work on gun installations for a particular bomber, since it was obvious that every turret configuration would have to be carefully co-ordinated with the aeroplane both structurally and aerodynamically. To this end they assigned the Boeing B-17 to the Sperry Gyroscope Company; the North American twin-engine B-25 bomber to the Bendix Corporation; the Glenn L. Martin twin-engine B-26 bomber to the Martin Company itself; and the Douglas Aircraft Company twin-engine attack bomber, A-20, to the General Electric Company.³⁶

While all these firms were highly qualified by years of manufacturing experience, none had any considerable knowledge of aircraft gunnery when they set out to design power-operated gun-turrets. The consequences of this deficiency can be illustrated by tracing the experience of one of the firms, Bendix, in some detail. But first it may be revealing to consider why long-established firms with many years of association with the Air Corps understood so little about aerial gunnery.

By long-standing regulation the official US Army practice was not to release classified military information to manufacturers until after a formal contract had been signed. No matter how great the urgency, under peacetime practice no contract could be signed until funds had been appropriated. Thus, while the Wright Field armament staff could negotiate with potential contractors and discuss their requirements in general terms, data such as ballistic tables and aircraft performance figures which carried security classifications could not be released until

a new fiscal year made funds available for a formal contract.³⁷

Even when funds were obtained, the Wright Field armament staff were not really prepared to give extensive advice to contractors. They had made no systematic study of the many basic engineering problems inherent in the powered operation of guns. Still unresolved were such questions as what kind of power-drive would give the best results, pneumatic, hydraulic or electric? They had made no exhaustive search of the available published literature. Nor had they pressed for an accelerated exchange of information with their Royal Air Force counterparts, who were not only the most accessible foreign source but far advanced in the field. Moreover, after twenty years of peace even those in the tactical units could scarcely claim to know what unexpected challenges and surprises a shooting war would bring.³⁸

Lack of familiarity with the fundamentals of aerial gunnery was endemic. When a Bendix engineer assigned to develop the gun installations on the B-25 visited Wright Field in search of information to improve his appreciation of the problems involved he was given a flight in a B-18 bomber, because no B-25 was then available. A fighter plane then made a few passes simulating attacks. This, according to the official who escorted him, was expected to make him 'thoroughly familiar' with the task in hand. Such flights for a contractor's engineers were undoubtedly useful, but a sceptic might be inclined to doubt that a single experience of this sort could ever make anyone 'thoroughly familiar' with the manifold challenges to be encountered in developing defensive armament.³⁹

That the Bendix engineers never did appreciate the realities of aerial combat is evident from the monstrosity they devised in the form of a lower turret for the B-25 to give all-round, 365° coverage of the bottom hemisphere. This vital turret employed a pulsating direct-current speed control which arced excessively and tended to stall at low speeds. Its designers had failed to appreciate what the British had learned years earlier: smooth tracking at very slow speeds is more critical than it is in the upper speed ranges.⁴⁰

The worst feature of the Bendix turret was its periscopic sight, an ingenious but impractical contraption. The designers claimed that the periscope reduced the impression of the attacking aircraft to a tiny scale on the lens, and thus facilitated identification by concentrating the image upon the area of maximum acuity in the human eye. What this utterly disregarded was the problem of scanning to pick up an enemy plane in the first

place. Using the bottom turret required the gunner to assume an uncomfortable kneeling position with his chest upon a padded rest and his face pressed to an eyepiece, a posture the designers apparently expected him to maintain throughout long stretches of a mission into enemy airspace.

When the Bendix turret was eventually tested aloft in a bomber, oil from the engine exhaust smudged the outside lens of the periscope, making the whole apparatus unworkable a few minutes after take-off. This and numerous other defects eventually led to the scrapping of the entire project. But this happened only after the expenditure of vast sums of money and the diversion of thousands of man-hours and acres of productive capacity.⁴¹

The unfortunate diversion of scarce skilled manpower and productive plant capacity because of the contractor's flawed conception of the nature of the problems of flexible gunnery was not the only reason for the dissipation of resources. Internal stresses within the technical staffs at Wright Field also contributed. In their preoccupation with striving for maximum speed the Aircraft Laboratory authorities, ever critical of bulbous gun-emplacements which added drag, urged the armament staff to design a central fire-control system whereby a single gunner in one central sighting station could control several small turrets inconspicuously faired into the fuselage. In anticipation of a next generation of pressurised high-altitude bombers the Armament Laboratory had already been thinking in this direction; so in early 1940 it sent out a request for bids to several leading manufacturers.⁴²

The specification for a central fire-control system called for a seven-gun installation providing coverage for the entire sphere surrounding a bomber. It was to have a computing sight with a range-finder and a double periscope for tracking above and below. The Sperry Gyroscope Company won the contract, largely because its earlier experience with naval gunfire controls allowed it to come up with a more fully developed design. After six months of effort, however, it became evident that developing a central fire-control system posed far too many engineering difficulties to be resolved in less than several years. So the project was shelved in favour of individually manned local turrets. Time, money, engineering talent and productive capacity had been diverted; but, once again, not all was lost, for Sperry was able to use many of the components in the upper and lower locally manned turrets the firm had contracted to build for the B-17.⁴³

The rest of the story is anticlimax. Once given a clear idea of what was wanted and the money to proceed, the major manufacturing firms along with their echelons of subcontractors began, after a slow start, to turn out turrets in the thousands.⁴⁴ And when the Boeing B-29 Super Fortress finally emerged toward the end of the war, it was equipped with a highly versatile central fire-control system. But, impressive as these achievements may have been, they were only what was to be expected when millions of dollars became available and some of the very best design talent in the nation could be drawn into the armament field.

When I was a young officer at the end of the Second World War a wise old general told me, 'Don't study our successes at the end of the war: study our failures at the beginning.' This was sound advice which I have tried to follow here. But in matters of *matériel* the beginning of the war is not 1939 or 1941, but 1918 and the whole span of the inter-war years when we were supposed to be preparing.

What insights can we derive from this historical account? While commercial requirements ensure a continual pressure to develop improved models of aeroplanes and engines, in peacetime there is little or no incentive for manufacturers to devise better aircraft armament without military contracts. A special burden of responsibility thus fell on the armament staff of the Army's air arm to take the initiative in pressing for continual improvement. This responsibility was not met, for reasons which should now be evident.

The experience of the inter-war years reveals rather pointedly that the Air Corps authorities failed to devise a suitable organisation with appropriate procedures to analyse the nature of the problem of self-defence for bombers. This shortfall was especially evident in the defective mechanisms concocted to ensure continual liaison with the users in the tactical or operational units. Nor was there adequate provision for periodic re-evaluations of existing doctrine. This resulted in the procurement of bombers with armament which flatly contradicted prevailing doctrine.

By neglecting to undertake systematic surveys of the technical literature, intelligence sources, attaché reports, and the like, the US Army air arm fell far behind its European neighbours in matters of armament. To explain all this away by pointing to the lack of sufficient funding from Congress is too facile an excuse. Many more readily remediable factors were involved. Limitations

on funding in peacetime are inescapable. But it is evident that, given a clear definition of the objectives sought – something not achieved by the Air Corps in the years between the wars – relatively small educational orders given to manufacturers to explore the potential of alternative solutions would almost certainly have paid disproportionately large dividends when the time for mobilisation and all-out production arrived.

While the staff members in the Armament Laboratory often displayed a want of imagination in the way they approached the problems of bomber defence in the lean years, the constraints within which they laboured must be taken into account. As late as the beginning of 1939 only one officer and two civilians were available in the Armament Laboratory to work on fire-control devices. Their total budget for research and development was \$25,000. Of this, \$10,000 was allocated to 'gun-mounts'. For the fiscal year ending in June of 1939, only \$14,000 was available for the direct purchase of equipment. In the following year the sum budgeted for such purchases jumped to \$215,000. At the time this seemed to constitute an enormous increase, although it was dwarfed by the millions that followed with the coming of war.⁴⁵

Manifestly, the armament staff faced more problems than they were equipped to solve financially or intellectually. A senior general assigned to Wright Field as a junior officer during the war to work on computing sights subsequently described the laboratory staff as 'fine mechanics', but lacking in scientific talent.⁴⁶ Not until the United States entered the war was there any significant influx of professionally qualified scientists. Thus to blame the armament staff for the shortcomings in bomber defence is to miss the essential point. The real source of the difficulty was more subtle, a conceptual failure on the part of the higher authorities in the Air Corps. It was they who apportioned funds amongst the laboratories at Wright Field and stinted the share for armament; it was they who gave primacy to aircraft performance over adequate armament; it was they who determined the size and qualifications of the professional staff in the Armament Laboratory. All of these neglects appear to have stemmed from a failure to understand the importance of sound doctrine based on experience and its relationship to the weapons being procured.

Notes

1. Chief, Technical Sect., AEF to Director of Air Service, 18 Nov. 1918, Wright Field Library, D72.11/33.
2. Lecture by H. O. Russell, 21 May 1921, in Wright Field Library, D70/71 and Capt. Dagnaux of Centre d' Etude de l'Aeronautique, 'Aircraft Armament' (translation), Wright Field Library D70/18.
3. David R. Mets, 'The Evolution of Aircraft Guns, 1912-1945' (Office of History, Armament Division, Air Force Systems Command, Eglin AFB, Florida, 1987), pp. 66-7.
4. *Ibid*.
5. Armament (Air Service Tactical School Course Outline, Langley Field, Va, 1924-5) 41, in Wright Field Library, D70/82. At 160 mph airspeed it required over 100 lb of physical exertion to move a gun broadside to the slipstream.
6. Chief, Armament Section to Chief, Engineering Division, Air Service, 2 May 1923. Air Adjutant General file, 473.5, Wright Field.
7. AC Technical Report 'Study to determine possible advantages and development of mounting machine guns flexibly on various principles of mounts', 19 Nov. 1926, Wright Field Library, D12 W/3170.
8. Military Attaché for Air, Italy, 'Brief summary of Italian aircraft armament', Report 16, 328, 23 Nov. 1937, Wright Field Library, D70/123, and C. G. Grey and L. Bridgman (eds.), *Jane's All the World's Aircraft: 1938*, Trowbridge, Wilts., 1972 repr. ed, p. 182c.
9. See I. B. Holley, jun., *Development of Aircraft Gun Turrets in the Army Air Forces: 1917-1944*, Maxwell Air Force Base, Ala., 1947), pp. 21-3. The first British power-turret was a Boulton-Paul in the nose of the biplane Overstrand bomber in 1934. The Vickers Wellington and Armstrong-Whitely both had nose-and tail-guns in the 1930s. See Marcus W. Bourdon, 'Aircraft Gun Turrets: The Development of British Types for Aerial Bombardment', *26 Army Ordnance* (March 1944), pp. 303-8.
10. Owen Thetford, *Aircraft of the Royal Air Force since 1918*, London, 1976, pp. 59-60. The first British turret to be deployed was the Bolton-Paul compressed-air installation on the Overstrand bomber.
11. Memo, Chief, Information Division, Air Corps, to Chief, Matériel Division, 3 Aug. 1937, Wright Field Armament Laboratory file, Machine Gun Mounts, 1937. The Air Service designation was changed to Air Corps by legislation in 1926.
12. Lt. Col. H. H. Arnold to chief of Air Corps, 26 Nov. 1934. Air Force Historical Research Center, 4686-35. A & B file, 'Pursuit Aviation', Maxwell AFB, Alabama.
13. Maj. Gen. Oscar Westover, Hearings before the Sub Committee on Appropriations, House of Representatives, 75th Congress. 1st Session, on the Military Establishment Appropriations Bill for fiscal year 1938, pp. 521-2.
14. 'Aerial Warfare in China', G-2 report 2657-H-439/1051, 14 Dec. 1938, and comments by Chief, Matériel Division, 10 June 1939 and Chief, Armament Branch, 29 May 1939, Air Adjutant General file, 336 'Foreign Reports', Wright Field.
15. Exec., Matériel Division, to Chief of Air Corps, 13 Dec. 1938. Air Adjutant General file 470, 'Armament Developments', Wright Field.

16. Air Service Tactical School, Langley Field, Armament, 1924-5 course, p. 41, Wright Field Library, D70/82.
17. Capt R. C. Coupland, Ordnance Dept., unpublished article, 'Aircraft Armament: US Army Developments', Aug. 1938, with attached correspondence, Wright Field Library, D70/91. Coupland rose to flag rank in the Second World War as the principal ordnance expert of the Army Air Force.
18. Lt. Col. H. H. Arnold to Chief, Air Corps, 26 Nov. 1934. Air Force Historical Research Center, 4686-35, A & B file, 'Pursuit Aviation'.
19. Memo, Capt P. E. Shanahan, for Lt. Col. O. P. Echols, 19 Feb. 1940, Armament Laboratory file, 'Expenditure Order 554-1-123', Wright Field.
20. Kenneth Munson, *Bombers Between the Wars: 1919-1939*, London, 1970, pp. 139-40; F. G. Swanborough and Peter Bowers, *United States Military Aircraft Since 1909*, New York, 1963, p. 218. The B-18 was a military version of the famous Douglas DC-2 passenger aircraft. In 1936 the Air Corps contracted for 133 B-18 bombers, the first such large-scale production order since the First World War.
21. See note 14.
22. Chief, Aircraft Laboratory to Chief, Armament Laboratory, 29 Oct. 1940, Armament Laboratory file, 'Machine Gun Mounts', 1940, Wright Field.
23. *Handbook of Instructions for Aircraft Designers*, 8th edn, 1st revision, 1937, section V, Armament, Dayton, Ohio, 1937.
24. Holley, *Development of Turrets*, p. 60.
25. Memo Report, Engineering Section, 1 Oct. 1935, Armament Laboratory file, Evaluation Folder No. 1 on Circular Proposal 39-800 and 38-385, Airplanes A-17 thru B-26.
26. TWX (i.e. teletype) Matériel Division, Wright Field, to Matériel Division, Washington, 26 Oct. 1939. Armament Laboratory Contract file, B-17B, Boeing ac10155, Wright Field. See also Boeing Specification 299R, 11 March 1940, B-17C and B-17D Specification, Model C-212-4, in ATSC Specification Branch file, 'obsolete', Wright Field.
27. Memo Report, Matériel Division, Washington, re Armament Conference, Office, Chief of Air Corps, held on 27 Dec. 1939, dated 8 Feb. 1940, in Air Adjutant General file, 'Fire Control: 1941', Wright Field.
28. Interview, W. G. McNeill, Armament Laboratory, and H. L. Anderson, Aircraft Laboratory, 11 Oct. 1944, with Wright Field Historical Officer.
29. Contract W535 ac 9977 23 June 1937, revised 29 Feb. 1940, and Change Order 7, 19 Oct. 1938, as well as Memo Report, Engineering Section, 10 March 1939 with related Unsatisfactory Report correspondence, Armament Laboratory file, Douglas B-18A Contract, folder No. 2.
30. Memo Report, Experimental Engineering Section, 10 Dec. 1942, and Inter-Office Memo, Chief, Production Engineering Section, to Chief, Experimental Engineering Section, 28 Oct. 1942, Armament Laboratory file, 'Expenditure Order 553-1-343'.
31. General Electric Co. to Matériel Division, Wright Field, 3 March 1939, Armament Laboratory file, 'Engineering Order 554-2-96', and Chief, Armament Laboratory, to Capt. C. S. Irvine, 2 Nov. 1939, Armament Laboratory file, 'Misc. Fire Control, 1940'.
32. Notes on conference at General Electric by M. E. Goll, 15 Nov. 1940, and Proposition ANG 33232, Mr. B. R. Prentice of General Electric, Schenec-

- tady, N.Y.', 21 Sept. 1939, Armament Laboratory file, 'Expenditure Order 554-2-96'.
33. Chief, Air Corps to Chief, Matériel Division, 9 June 1939. Air Adjutant General file, 470, 'Armament Development', Wright Field.
34. Inter-Office Memo, Chief, Armament Laboratory, to Chief, Experimental Engineering Section, 9 Jan. 1940, Armament Laboratory file, 'Expenditure Order 553-1-335'.
35. Air Corps Board Report No. 53, 'Fire Power of Bombardment Formation', Annex V, 3 Jan. 1940, Armament Laboratory file 'Misc. Confidential Correspondence'.
36. M. E. Goll to W. G. McNeill, 18 March 1939, Armament Laboratory file, 'Misc. Fire Control 1940', and Holley, *Development of Turrets*, Chapter 6.
37. Chief, Experimental Engineering Section to Sperry Gyroscope Co., 1 May 1939, Armament Laboratory file, 'Misc. Fire Control, 1940'.
38. Routing and Record Sheet, Matériel Division, Washington, to Matériel Division, Wright Field, 8 March 1940, Armament Laboratory file, 'Misc. Secret Correspondence, 1940', folder 2. For example, not until this date had a survey of attaché reports on British turrets been conducted.
39. Memo Report, Engineering Section, 20 Sept. 1939, Armament Laboratory file, 'Expenditure Order 553-1-119'.
40. Contract W535 ac 14144, 14 May 1940, and Bendix Corp. to Matériel Division, Wright Field, 17 June 1940, Armament Laboratory file, 'Expenditure Order 553-1-119'.
41. Inter-Office-Memo, Chief, Ordnance Dept. to Chief, Armament Branch, Sept. 1940, Armament Laboratory file, 'Expenditure Order 553-1-119' and Holley, *Development of Turrets*, pp. 248-54. The Bendix lower turret was subsequently salvaged by switching to amplidyne power-drives and direct sighting when used as a chin turret on the B-17G.
42. Chief, Engineering Section to Director, Army Aeronautical Museum, 15 Nov. 1938, Armament Laboratory file, 'Misc. Correspondence, 1938'.
43. Memo Report, Production Engineering Section, 9 July 1940, Air Adjutant General file, 473.5 General, Wright Field.
44. For an account of the mass production of turrets see Holley, *Development of Turrets*, Chapters X and XI.
45. Abstract of Costs, Fiscal Year 1938. The relative status of armament in air-arm thinking can be seen in the allocation of funds in fiscal year 1938: \$25,000 for all armament items, \$20,000 for balloons, \$100,000 for propellers. See also Research and Development Program, Subtitle 8, Fiscal Year 1940, Armament Laboratory file, 'Research and Development' and Chief, Engineering Section to Chief, Armament Branch, 20 Jan. 1939, Armament Laboratory file, 'Misc. Fire Control, 1940'.
46. Interview with Lt. Gen. Leighton I. Davis, USAF, by Maj. L. R. Officer and H. H. Aumann, 23 April 1973, Air Force Historical Research Center, K239-0512-568.

8

The High Command of the French Air Force and the Problem of Rearmament, 1938–1939: A Technical and Industrial Approach

Patrick Facon

During the Riom Trial, there was an interesting polemic between the Air Minister, Guy La Chambre, and the Chief of the Air Force General Staff, General Vuillemin, on the question of the definition and implementation of aeronautical programmes. The first question put to General Vuillemin, on 27 July 1942, by one of the members of the Supreme Court, was:

In the course of his interrogation programme during the hearing, Monsieur Guy La Chambre explained the stages preceding the establishment of a plan for the construction of aircraft. According to him, the conception and birth of an aircraft are the sole responsibility of the General Staff, who begin by proposing a General Staff programme, in which it states the required characteristics and performance of the aircraft. This programme is then forwarded to the Technical and Industrial Department of the Air Ministry, which distributes it among the designers. The latter then endeavour to design a prototype meeting the requirements of the command, which in turn examines the merits of this prototype and, if necessary, asks for modifications or improvements to be carried out. Once the prototype has been chosen, the General Staff, on its own responsibility, draws up the requirements. It would thus appear that the role of the Air Ministry consists solely in ensuring the execution of this plan, over which it has no jurisdiction. It could therefore not really be blamed for the inadequacy of the plan; nor could it be reproached for the disproportion between the German and French air forces.¹

In reply to this fundamental question, General Vuillemin said:

As far as the development of aircraft is concerned, the process is indeed that described. However, the General Staff programme was prepared taking into account only the technical possibilities of that time and the progress that could reasonably be expected in the near future. This information was provided by the Minister [Technical and Industrial Department]. It is true that the plan of requirements was drawn up by the General Staff, but it was presented for discussion to the Supreme Air Council [Conseil Supérieur de l'Air], which was presided over by the Minister. It was based on feasible or even possibly feasible aircraft designs. [...] I find it extraordinary that the Minister, who was President of the Supreme Air Council which discussed and adopted Plan V, should seek to disclaim responsibility by blaming the General Staff, which was merely a body subordinate to him.²

In quoting these remarks, it is not our intention at all to apportion the blame for this or that disaster to this or that person. We merely wish to demonstrate the lack of clarity in the delicate matter of the rearmament of the French Air Force. The extracts presented here should not be taken as anything other than what they are, i.e. addresses to the court made in the interest of the defendants during a trial, the aim of which was to apportion blame for the defeat of 1940 to the political leaders of the final period of the Third Republic. However, in our opinion, these few lines constitute a good introduction to the theme which we shall be exploring at this conference, namely the role of the High Command of the French Air Force in the determination and implementation of rearmament during the years immediately preceding the Second World War. This paper will focus on General Vuillemin, whose pre-war policy has been severely criticised and whose conduct of the air battle in May-June 1940 has often been the subject of unflattering comments. We shall not deal here with Plan V, which has already been examined in detail in a previous study,³ nor with the attitude of General Vuillemin in the face of the German threat and the crises which shook Europe in 1938 and 1939.⁴ We shall concentrate on exploring how the General Staff of the French Air Force influenced the conception and implementation of Plan V, its relations in this connection with the Air Minister and its relations with the aeronautical industry. In short, we shall attempt to describe the complex mechanisms which governed the rearmament of the Air Force in the two years preceding the war.

Why are we limiting ourselves to the short period between January 1938 and September 1939? Basically, because the problem

of rearmament of the French Air Force, begun in 1933 and still incomplete by June 1940, is a vast subject, which would fill several volumes. Thus, a paper devoted to it would only be able to skim the surface. Another reason is that the period 1938-9 is very well documented. From the minutes of the Committee of National Defence to the reports of the Supreme Air Council and of the Equipment and *Matériel* Committee, there is no shortage of documents. Fortunately, these archives are complemented by the papers bequeathed to the Air Force Historical Office by the family of General Vuillemin⁵ and the heirs of the Minister, Guy La Chambre.⁶

The Men: Vuillemin, Guy La Chambre and Others

When he was appointed Chief of the Air Force General Staff, on 22 February 1938, General Vuillemin relinquished his post as Commander of the First Air Corps in order to assume the functions of General Féquant, his predecessor as Chief of the Air Force General Staff. The man who assumed control of the Air Force in this troubled period marked by Hitler's claims to Austria and by the crisis of the Popular Front majority in France was certainly not lacking in courage. His entire career shows that Joseph Vuillemin never hesitated taking personal risks, both during the First World War, where he was one of the major figures responsible for the development of French bomber forces, and during the immediate post-war period, when he introduced long-range flights, which made him famous. Subsequently called to very high office, Vuillemin occupied the post of Deputy Inspector (*Inspecteur Adjoint*) of the heavy defensive air forces, i.e. bomber forces, before becoming in August 1936 Commander of the First Air Corps in Paris and, the following year, a member of the Supreme Air Council.

The new Chief of the Air Force General Staff was undoubtedly a man of action. But was the Joffre of the airmen, as the specialist air press liked to call him, the commander – i.e. the organiser, technician and expert on the issues involved – that the Air Force needed to bring about the urgently required recovery? There are differences of opinion on this basic question, and it is very difficult to reach a fair judgement. In the opinion of Anatole de Monzie, the Air Force had, at that time,

almost as many generals as crews or aircraft. [...] Several of these

generals were intellectually superior to Vuillemin; but they were involved in rivalry, which General Vuillemin was spared because of his legendary reputation. Hence the preference! Camelin and Vuillemin were appointed in order to avoid rivalry. Neither of them was very bold. Any good commander gives rise to risks: our France did not want any risks.⁷

Could men such as Jauneaud, Head of the Military Cabinet of Guy La Chambre's predecessor, Pierre Cot, have assumed this role? De Monzie suggests so, although not in so many words, when he emphasises that this controversial figure was one of the 'high-ranking technicians who offered him [the Air Minister] suitable programmes'.⁸ The choice of Vuillemin by Guy La Chambre was undoubtedly a direct reaction to the policy pursued by the Cot-Jauneaud team at the Air Ministry from 1936 to 1938. Did not Guy La Chambre write that he replaced General Féquant because the latter was 'guilty of having handed over the privileges of his office to General Jauneaud, Head of the Military Cabinet of Monsieur Pierre Cot, who in reality acted as Chief of the General Staff'?⁹ As Arnaud Teyssier has shown, the appointment of General Vuillemin by Guy La Chambre was a highly symbolic gesture intended to reassure an Air Force that had become somewhat confused.¹⁰ Did not Vuillemin himself speak of this crisis of confidence in a letter addressed to Guy La Chambre and dated 15 January 1938 - i.e. before the new Air Minister had even assumed office (18 January 1938) in the new Chautemps cabinet?¹¹ The choice of Vuillemin was thus probably more of a 'political' nature than a technical or military one.

The men who General Vuillemin gathered round him to carry out this recovery are rather enigmatic. One of the most remarkable was undoubtedly Colonel Mendigal, 'more "intellectual" than Vuillemin, more used than him to working with files'¹² who was to be a 'loyal, hard-working and heeded adviser'.¹³ The other important figure in the entourage of the new Chief of the Air Force General Staff was Colonel Bergeret, who was to occupy very high-ranking posts under the Vichy regime. However, information relating to this ambitious, discreet and undoubtedly competent man is scarce, at least as far as this period is concerned.

With whom was the Air Force General Staff dealing with at the Air Ministry? First and foremost, of course, the Air Minister. What can we say about Guy La Chambre other than that he embodied a certain political success? As far as military issues

were concerned, he had occupied the post of Undersecretary of State as the War Ministry (Sous-Secrétaire d'État à la Guerre) in 1932, when he was scarcely thirty-four years old, and had been elected President of the Army Committee in June 1936. Robert Frankenstein has written of him: 'In the political climate of 1938, a radical more moderate than P. Cot reassured the aeronautical industry and the rue de Rivoli.'¹⁴ In contrast to Pierre Cot, adds Robert Frankenstein, Guy La Chambre 'had more elbow-room and was not content with reaping the fruits of the reforms of his predecessor; he took advantage of the larger budget given to his ministry for the completion of the necessary modernisation of the aeronautical industry.'¹⁵ Apart from these favourable circumstances, the Air Minister and the Chief of the Air Force General Staff had the advantage of getting along well with each other. On several occasions, especially during the Riom Trial, General Vuillemin acknowledged that Guy La Chambre was 'one of the best, if not the best Air Minister that we have ever had'.¹⁶ And did not the Chief of the Air Force General Staff add that the Air Minister had always shown an exceedingly high degree of goodwill towards him? In short, it would appear that the two men upon whom the great responsibility for the recovery of the Air Force devolved enjoyed a frank, even amicable relationship.

The immediate entourage of Guy La Chambre included the Inspector of Finance, Hoppenot; his *chef de cabinet*, who had assumed office under Pierre Cot; and General Bouscat, Head of the Military Cabinet, who had previously commanded the Air Force in Morocco, the Air Force Academy in Versailles and the First Air Force Region, and who would eventually hold very high office. Another important factor of the General Staff in the Air Ministry was the Inspector General, Joux, who was responsible for the Technical and Industrial Department. His functions were performed in the cabinet of Guy La Chambre by a talented young engineer, Stéphane Thouvenot, who gave him 'effective support in the formulation of decisions'.¹⁷ Other engineers, such as Joseph Roos, a graduate of the École Polytechnique (Military Academy of Artillery and Engineering), and Volpert played a not inconsiderable role. Albert Caquot, a highly-talented engineer, who introduced the policy of prototypes and who had been dismissed from his post a few years earlier, returned to political life at the head of the National Aeronautical Construction Companies.

Compared with his predecessors at the top in the Air Force, General Vuillemin enjoyed a distinct advantage as far as rela-

tions with the various bodies of the Air Ministry were concerned. Determined to strengthen the privileges and powers of the Chief of the General Staff in order to restore 'a more precise concept of responsibilities',¹⁸ the Air Minister laid down, in the Decree of 5 March 1938, that the aforesaid Chief of the General Staff was to be entrusted with the task of determining the requirements of the Air Force. Moreover, he increased the powers of General Vuillemin *vis-à-vis* certain bodies of the ministry; thus, 'the Director of Military Air *Matériel* and the Director of Military Personnel, while retaining their administrative autonomy and the responsibilities derived from it, will subordinate their action to the directives of the Chief of the Air Force General Staff'.¹⁹ The philosophy behind this series of decisions was explained by Guy La Chambre in one of the papers he prepared for his defence in the Supreme Court of Justice. Proceeding from the principle that the first of his concerns on arriving at the Ministry was to establish whether the resources which the High Command of the Air Force had at its disposal corresponded to its requirements, Guy La Chambre emphasised:

The only way to appreciate the responsibility incumbent upon the various ministers of national defence in the preparation for the war is in relation to the satisfaction of the requirements expressed by the High Command. These requirements themselves are calculated, for each of the departments of national defence: War, Air Force, Navy, on the basis of the war plan. The conception and establishment of the war plan are, in peacetime, one of the prerogatives and one of the essential tasks of the High Command responsible, in wartime, for the conduct of operations. [...] Under the auspices of the Chief of the General Staff of National Defence, tasked with co-ordinating the action of these different forces, the Chiefs of the General Staff of the ministerial departments concerned draw up and propose to their respective ministers the armaments programmes necessary to perform the tasks assigned in the war plan to the category of forces for which they are responsible.²⁰

In clarifying the matter in this way, the Air Minister endeavoured to prevent, in future, all the abuses he discovered when consulting the minutes of the Supreme Air Council and those of the National Defence Committee and in discussions with the members of the Supreme Air Council. He thus realised that a detailed plan for 1,500 aircraft was not submitted to the aforesaid council in January 1936, and that this council was not asked for its opinion as to whether this plan met the

requirements of the High Command in terms of both quality and quantity, in view of the development of the international situation. In order to avert what he called a divorce between the Ministry and the Air Force General Staff and to prevent henceforth a situation in which the actions of the minister did not correspond to the requirements of the Air Force, Guy La Chambre reorganised the Supreme Air Council by removing from it the civilian members entitled to speak and vote. In conclusion, the measures adopted by Guy La Chambre determined clearly the responsibilities of the General Staff, and it cannot be denied that the new Air Minister provided General Vuillemin, with whom he enjoyed good relations, with resources he required.

All these arguments give rise to one question. With what we know of the intentions of Guy La Chambre to redress the situation completely, can we simply say that General Vuillemin was only chosen for 'political' motives, with the sole aim of 'mustering' the Air Force? Or was General Vuillemin not also appointed Chief of the General Staff on the strength of organisational and technical competence? Guy La Chambre was too intelligent and too shrewd a man to make such a mistake with regard to his Chief of the General Staff by giving such responsibility to a man who had 'none of the qualities required of a chief of the general staff'²¹ and who was only 'the flag of the Air Force'²² because he could not be 'its brain'.²³

The Legacy

What was the legacy awaiting Guy La Chambre and General Vuillemin when they took office? To answer this question, it is necessary to consider three different spheres: firstly, the situation of the French Air Force at the beginning of 1938 in terms of *matériel*; secondly, the planning of the rearmament of the Air Force from 1933 onwards and the results it achieved; and thirdly, the aeronautical industry.

The situation of the Air Force at the beginning of 1938 can hardly be described as brilliant. In the letter that he addressed to the Air Minister – who had not yet assumed office – on 15 January, General Vuillemin stressed the alarming state of the air forces, underlining that 'no daytime mission in fine weather is possible without risking considerable losses. Night missions could only be flown against targets which are easy to locate and

not too heavily defended, and only by some of our forces.²⁴ In conclusion, the Commander of the First Air Corps was of the opinion that 'the situation is extremely serious. We do not know what the future holds for us, but I am firmly convinced that if a conflict were to break out, this year the French air forces would be crushed in a matter of days.'²⁵ On 1 January 1938 the French air fleet comprised 1,350 aircraft, four-fifths of which came from orders placed in 1935 under the Denain Plan, and were thus obsolete types.²⁶ Compared with the German aircraft in service at the same time, those of the French Air Force had a speed that was around 100 to 120 km/h lower.²⁷

The High Command of the Air Force estimated that the Luftwaffe and Regia Aeronautica had bombing capabilities over a distance of 500 km of 1,200 and 650 tonnes respectively, whereas the capabilities of the French Air Force were 500 tonnes over a distance of 500 km, and those of the Royal Air Force were 480 tonnes over the same distance.²⁸ These figures are, however, purely theoretical, since the capabilities of the French air forces were, as we have already pointed out, drastically reduced by the poor quality of their aircraft. In this respect, General Vuillemin wrote:

The *matériel* programmes were established around 18 months ago without even consulting me in the matter of bomber forces, for which I am, after all, responsible. It was only by chance that I learnt of it and was thus able to make a few remarks relating, in particular, to the light and rapid bomber, which had not been included in the programme. A cautious assessment reveals that we do not at present have anything with which we can conduct daytime bombing operations which would, using these rapid aircraft, yield the best returns of all offensive operations.²⁹

The situation was even more unfavourable as far as fighter forces were concerned, because the number of planes in this category capable of flying at speeds in excess of 400 km/h ran to 55 in France, 90 in the United Kingdom, 400 in Germany and 590 in Italy. The state of the French Air Force was such that during his visit to London in November 1937, the Prime Minister, Camille Chautemps, had to listen to some harsh criticisms on this matter from the British Prime Minister, Neville Chamberlain, who told the French Foreign Minister, Yvon Delbos: 'You do not have any modern aircraft whatsoever, and you are not able to produce any.'³⁰

The situation was not much better for planning the rearmament of the Air Force. This was not, however, for want of effort on the part of the Air Ministers and Chiefs of the Air Force General Staff who succeeded one another between 1933 and 1937. The first plan to enlarge the Air Force dates back to 1933; this was Plan I, called the Plan of the 1,010, under which the French Air Forces were to be completely re-equipped by means of a total renovation of obsolete aircraft and by providing the Air Force – created by the Decree of 1 April 1933 – with the resources required for the employment of this *matériel*, in particular airfields, ammunition and communications. The aim of this plan, which was adopted by the parliamentary bodies in July 1934, was to have 1,010 warplanes in service in the front-line units with an additional 333 aircraft in a state of operational readiness, in other words a total of 1,343 warplanes under Plan I.³¹ Submitted to the Supreme Air Council for deliberation in June 1933, this plan was to be implemented in three annual stages from 1934 to 1936, as part of the Programme of Major Work of Interest to National Defence. The figures in this programme were subsequently to undergo a few changes, and finally amounted to 1,023 front-line aircraft and 432 in an operationally ready status, i.e. a total of 1,365 (474 bombers, 480 fighters and 411 reconnaissance aircraft).

For reasons of space, we shall not go into details about the aircraft provided for in the plan, but it must be pointed out that, in the field of reconnaissance, the multi-seater combat aircraft or BCR (bomber, combat, reconnaissance) was to play a major role, as it provided the Air Force with a sizeable number of aircraft to carry out bombing missions in support of the normal bomber force, should the need arise. The orders placed under this plan were spread over a long period stretching from 1933 to 1936: those placed in April and May 1935 were particularly extensive, following a decision taken by General Denain, the then Minister of Air, who believed that a war with Germany was imminent. In this connection, Contrôleur Chossat noted: 'the illusions that people had in the spring of 1935 in placing orders which were enormous for that time, without worrying whether the industry would have the capacity to absorb them'.³² Since this policy led to congestion in the industry, which in turn resulted in a succession of delays, 'the term "modern *matériel*" could not be applied to the aircraft intended for the renovation of the formations: this *matériel* was in 1936 perhaps new but it was certainly not modern'.³³ Thus one of the most perverse effects of

the inability of an industry still at the level of artisans to adapt to large-scale orders manifested itself: an increasingly large discrepancy between technical programmes and the delivery of *matériel*, a discrepancy which explains why good warplanes were obsolete when they arrived in the units (the aircraft of Plan I, some of which were still in service in 1940, dated from the 1930 and 1932 technical programmes).

Plan I had not yet been implemented when, on 25 August 1936, parliament adopted a so-called five-year plan, which provided for the complete renovation of the Air Force over a period of five years, in other words by 1941. Launched in a less than favourable social, economic, financial and industrial context, the five-year plan did not get further than the first stage, and the aircraft scheduled for this stage were delivered five months to one year late. Moreover, it was distinctly handicapped by the lack of prototypes for which large-scale orders could be placed.

The situation became more complicated when, on 7 September 1936, the Cabinet decided to enlarge by 50 per cent the air force envisaged by Plan I and to launch Plan II, which, in fact, included the five-year plan. This time, the number of front-line aircraft was to be increased from 1,000 to 1,500 with a view to developing the heavily defensive air forces up to an offensive power comparable to that of the German bomber forces. Counting the reserves, this plan was to provide the French Air Force with 2,851 aircraft, including 1,339 bombers (i.e. 46 per cent of the total). The first orders, placed at the beginning of 1937, were only for already obsolete aircraft, but, for financial reasons, Plan II never got past the design stage, because it was never even submitted to parliament.³⁴

Whereas Plan II emphasised the offensive power of the Air Force, Plan IV, proposed by the Air Force General Staff on 15 February 1937, stressed the improving of air-defence resources, and provided for augmentation of the light defensive air forces, i.e. fighters. Pierre Cot, who had not been informed about the formulation of this draft, rejected it.

He did not want to block up once again a poorly equipped industry with the production of obsolete *matériel*. [...] The attitude of Pierre Cot was in line with the financial policy being pursued at that time, i.e. 'the pause'. But, in fact, at the industrial level, the Air Minister had been right: a plan more ambitious than the current Plan II, without new prototypes on the horizon and without modern equipment in the factories, and at the very time when expropriation

procedures were under way, would only have created more disorganisation in an already ailing industry.³⁵

The French aeronautical industry was undoubtedly ailing. It could not cope with the orders placed under Plans I and II. Reorganised, restructured and concentrated in 1936 and 1937 through nationalisation, it suffered from lack of investment and a coherent industrial equipment policy. Describing the situation of this industry at the end of 1937, Emmanuel Chadeau wrote: 'From that time onwards, two-thirds of the aeronautical industry were in the hands of state-owned enterprises. But their working methods, a mixture of the habits of private industry and the methods of the public sector, were unsatisfactory as a result of restraint and poor efficiency.'³⁶

General Vuillemin and Plan V

As has already been stated in the introduction to this study, it is not our intention to deal with Plan V here. We shall just give a broad outline of it by way of a background to our topic here, that is, how the High Command established the requirements of the Air Force within the scope of rearmament in 1938 and 1939.

It is certainly not a bad idea to look at the contexts in which the decisions concerning the requirements of the Air Force were taken. Once these requirements had been determined by the General Staff, within the framework laid down by Guy La Chambre in the Decree on 5 March 1938, they were submitted to the Supreme Air Council. This body, whose role was defined in April 1931 when it was set up and then specified in the decrees issued in April and September 1936 and in February 1938, was charged with examining organisational questions, recruitment and the provision of aircraft. It also had to examine the repercussions that the introduction of new equipment was likely to have on the operational doctrine of the air forces. Finally, its mission was to consider all the problems related to the air forces' preparations for war. The Supreme Air Council only had a consultative function, and the final decisions were taken by the Air Minister in liaison with his General Staff. Who belonged to this body? The Air Minister – obviously – as its president, the Chief of the General Staff, who was the vice-president, and five major-generals who had been inspector generals for at least a year, an air region commander, and an air corps commander or

a section head in the Air Force General Staff. However, if he considered it appropriate, the Minister of Defence could also attend the meetings of this council, as could members of the Government, who were entitled to speak but not to vote. Finally, the Chiefs of Staff of the Army and Navy were also allowed to participate in these meetings of the Supreme Air Council.

In the Air Ministry, questions relating to the implementation of the armaments programmes and technical problems were dealt with by the *Matériel* Committee, which comprised the Air Minister, representatives of the Minister's military and civil cabinets, the Chief of the Air Force General Staff, the Air Force Chief of Staff, the Head of the Technical and Industrial Department and the Head of the Military Air *Matériel* Department. The meetings of this committee were sometimes attended by delegates from the Army or Navy.

Finally, overall decisions were taken by the Standing Committee on National Defence. Here, air-force problems were dealt with as part of the nation's general military policy. This committee, presided over by the Prime Minister, comprised the most senior French political and military figures, in particular the Minister of Finance, the Chiefs of the General Staff of the three services, the Secretary-General of the Ministry of Defence and the Army (in this case the *Contrôleur Général*, Jacomet) and the Secretary-General of the Supreme National Defence Council.

From the beginning of 1938 until mobilisation, the rearmament of the French Air Force took place within the framework of what was known as 'Plan V'. We shall only touch very briefly on this plan, which was first proposed at the end of 1937, and about which Robert Frankenstein has written: 'The programme envisaged by P. Cot in his letter to Chautemps (6 December 1937) was the origin of Plan V. But it was the new minister, Guy La Chambre, installed in his Office on the Boulevard Victor in January 1938, who was to get it approved by the government.'³⁷

The deterioration of the situation in Europe at the beginning of 1938, the alarming reports of the Military Intelligence Service on the rearmament of the German Luftwaffe, and the staff talks held between the French and British in 1937 necessitated a total revision of the requirements of the Air Force. On 6 December 1937, the Standing Committee on National Defence set out to determine these requirements in terms of the overall military situation. As soon as Guy La Chambre became Air Minister, he

asked the Air Force General Staff to draw up a programme which would satisfy the new requirements.

The plan, which was submitted to the highest national defence authorities on 8, 9 and 15 March 1938, took into account the rearmament of the British air forces and envisaged seeking help from various foreign aeronautical industries, principally that of the United States. It was to enable the French Air Force to withstand the Luftwaffe, while the Royal Air Force was to attain a level enabling it to face the Regia Aeronautica. Originally, Plan V was to be implemented between 1938 and March 1941 in three successive stages. However, following Hitler's *Anschluss* of Austria, its implementation time was reduced to two years, that is, it was to be implemented by March 1940. Since General Vuillemin considered the reinforcement and development of the fighter forces indispensable to the defence of the country, he insisted that this particular point should figure among the main objectives of the plan. He thus proposed that the bomber forces should be relegated to second place, adding that the *matériel* of this type envisaged by Plans I and II was adequate for night missions. In all, Plan V intended to give the Air Force 2,617 front-line aircraft and 2,122 in reserve, a total of 4,739 aeroplanes. In addition, the General Staff envisaged an extensive training programme. There were to be an additional 600 officer pilots and observers, 100 officer mechanics, 1,500 to 2,000 pilots from the NCO corps and the ranks, 1,200 machine-gunners, 1,000 radio-navigators, 10,000 aircraft mechanics, 800 equipment mechanics, 600 armourers, 100 photographers, 1,000 radio operators and 1,000 electricians.³⁸

The implementation of Plan V was hit by several setbacks, as we can well imagine. Thus, in May 1939, on completion of the first one-year phase, the situation was dramatic. Not one single light bomber or assault aircraft had left the assembly line, while the aeronautical industry had only manufactured 147 modern single-seater fighters. Output in 1938 was so low that of 1,061 Morane-Saulnier MS 406s ordered, only 27 had been delivered; of 575 Potez 630s and 631s ordered, only 73 had been delivered; and of 142 Bloch 131s ordered, only 55 had been delivered.³⁹ Between April 1938 and February 1939, the requirements of the Air Force rose to 4,821 aircraft (2,677 front-line and 2,144 in reserve). However, the greatest changes were decided upon by the Supreme Air Council on 28 March 1939, following the entry of German troops into what remained of Czechoslovakia after it had been carved up at Munich. This 'readjustment of require-

ments, as it was called by the Air Force General Staff, involved the construction of 5,133 aircraft (2,854 front-line and 2,279 reserve) and the creation of new units, with two bomber wings which were to form the Imperial Division (an element intended to ensure defence of the overseas territories). Finally, on 13 June 1939, Guy La Chambre decided to extend the initial Plan V to cover the whole of 1940, with a third slice being added to the original programme. This was practically a return to the Plan V of the period preceding the invasion of Austria. Under this plan, which retained the title 'Plan V', 8,094 aircraft were to be built (8,558 if we include the colonial air forces, regarded as being outside the scope of this programme), and the rate of production was fixed at 330 airframes per month.⁴⁰

How did the Air Force General Staff act in the situation described above? To answer this question it is necessary to examine French aeronautical policy in 1938 and 1939. Throughout 1939, General Vuillemin pursued a policy from which he did not depart. For the Chief of the General Staff, fighting a war against Germany with the air-force resources that France had at her disposal was out of the question. He made this quite clear to the Standing Committee on National Defence on 15 March 1938, repeated it after his August 1938 trip to Germany, from which he returned very impressed, and reiterated it at the time of the Sudetenland crisis in September of the same year. It emerged from General Vuillemin's statements that the French Air Force would be crushed in less than a fortnight in the event of a conflict with Germany. 'What do we have to pit against 5,000 modern German and Italian front-line aircraft? At the moment, nothing. By 1 April 1939, probably less than 500 aircraft, and they are to be flown by crews who will not have had enough time to learn how to get the most out of them,'⁴¹ the Chief of the General Staff told General Gamelin on 25 October 1938.

Nor is it possible to understand how the Air Force General Staff determined the aircraft-requirement policy without considering staff training, which was essential. How, indeed, were aircraft supposed to be flown when there were not enough pilots? Certain statements made at Riom may lead one to believe that, in this sphere of industrial production, General Vuillemin did not prove realistic. Thus, the engineer Joseph Roos, in his statement at the Riom Trial, asserted:

In January 1939, I indicated to the Minister that it was possible, according to precise industrial hypotheses, to achieve a monthly

output of 370, 500 or 600 complete warplanes throughout 1940. The Minister summoned Generals Vuillemin and Keller (Air Force Chief of Staff), Monsieur Caquot and myself to a meeting with him. The two chiefs of staff put the monthly requirements for 1940 at 40 to 60 aircraft. Two months later, a monthly output of 330 aircraft was fixed – less than the lowest of my proposals. Production was thus very seriously restricted, especially in the case of investments and raw materials, for which an upward economic trend is particularly favourable.⁴²

What is to be made of such statements? It is best to compare them with the archive documents of that time. What was General Vuillemin's position on this? During the Riom Trial, the Chief of the Air Force General Staff stated that he 'did not underestimate the requirements'.⁴³ Also at Riom, General Bergeret did not fail to cover for his superior at the time, by emphasising that it was the low capacity of the French aeronautical industry which limited the requirements expressed by the General Staff to which he belonged:

Since everyone was in agreement on the urgency of a maximum build-up of the French Air Force, it was, in the final analysis, the possibilities of implementation and, more than anything else, the possibilities of industrial production which were to limit the figures expressing the requirements. There was only one man on the Supreme Air Council who was entitled to say whether the effort demanded of the industry was above, below or at the level of its current and future possibilities, and that was the Air Minister, who was the head of this industry.⁴⁴

Admiral Darlan's former secretary of state at the Air Ministry added that the drawing up of the initial Plan V had been based on a supposedly stabilised situation of the German and Italian Air Forces on 1 January 1938. If the Supreme Air Council had only considered this one aspect, it could not but have called for the activation as quickly as possible of a 10,000-aircraft Air Force, but examination of the other aspects of the problem led to this figure's being reduced to what was actually possible, that is, 4,739 to be constructed by 31 March 1940.⁴⁵ General Vuillemin recognised that, given the state of French industry in 1938, 'the establishment of a plan for 5,000 to 6,000 aircraft would have been simply Utopian, because it would have been impossible to implement it within a reasonable period of time'.⁴⁶ According to him, Plan V was the first stage of a future Air Force, it 'could

obviously be modified while it was being implemented and, when it was just about to be concluded, was to be replaced by a new plan which would take into account the existing situation and new possibilities'.⁴⁷

Did those in charge in the Air Force of 1938-40 simply pass the buck to the aeronautical industry? Did they deny their own mistakes during the Trial of Riom in order to blame the Air Minister? The situation was not that simple. In their defence, it must be said that Plan V was reshaped on several occasions as a result of developments in the international situation and the growing capacity of the aeronautical industry. The aircraft-production figures envisaged in the programme increased from 4,739 in March 1938 to 8,094 in June 1939. If we consult the archives of that period, it becomes apparent that the General Staff, far from underestimating its requirements, increased them. At a meeting on 9 November 1938, the Air Minister asked General Vuillemin whether the Air Force would be able to defend the country with the 1,305 aircraft it was to have at its disposal by June 1939. The Chief of the General Staff replied 'Just about'.⁴⁸ How can the Air Staff be accused of faint-heartedness when, at the same meeting, General Vuillemin proposed increasing to 900 units an order for Potez 63.11s, which the Air Minister had initially limited to only 400? Guy La Chambre then announced that the Prime Minister intended to purchase the remaining aircraft in the United States. It was thus very much an industrial problem confronting those in charge in the French Air Force.

This does not mean, for all that, that the Vuillemin team emerges with a clean slate from this affair of the Air Force requirements. During the Riom Trial, Guy La Chambre told the judges that he had to intervene in 1939 in order to force a General Staff which believed itself equipped to carry on with production of the Morane-Saulnier MS.406. It was also thanks to his stubbornness *vis-à-vis* the Air Force High Command that an initial order for modern Dewoitine D.520 fighters was placed in March 1939.⁴⁹

At the technical level, Plan V was launched with aircraft designed between 1935 and 1937 (MS.406, Amiot 350, Potez 63 and Bloch 151), and their production was to be completed by 1940. However, the delays affecting production of these aircraft meant that there was no chance of having new aircraft for 1940.

What about the technical and doctrinal policy pursued by the Air Force General Staff? We shall not go into the polemic

surrounding the problem of low-level bombers and dive-bombers in France before the war.⁵⁰ We believe, however, that it would be interesting to mention, by way of a conclusion, the controversy between the various opposing protagonists in the Riom Trial on the question of priority given to the fighter forces in 1938 to the detriment of the bomber forces. This problem is connected with the more general one of the operational doctrine of the Air Force, which was part of French military strategy at that time. The emphasis placed on fighter forces can be explained initially by the defensive attitude which France wished to retain *vis-à-vis* Germany and Italy. Moreover, it must be recognised that, in the matter of bomber forces, General Vuillemin preferred to rely on British resources.⁵¹

Finally, we should not forget that when the Air Force General Staff determined its bomber requirements within the scope of Plan V, the number of prototypes available was minute. General Bergeret pointed this out in the court-room at Riom when he stated that, at the technical level, it had been impossible to envisage a decision other than that to give priority to the manufacture of fighters 'given the situation regarding [bomber] prototypes at this time'.⁵² He added that 'tactically, in view of the distinct air superiority of the enemy and the deficiency of French anti-aircraft defence and territorial air defence, there was no question of taking another decision [that to develop the fighter forces first]'.⁵³ It must be said, as General Vuillemin emphasised, that the only two bomber prototypes available at the time of the drawing-up of Plan V (Lioré-et-Olivier LeO 45 and Breguet 690) were technically deficient, and their perfection would take a long time. How, in effect, would it have been possible to start the large-scale production of aircraft which had not yet been fully developed?

These few remarks lead us on to the delicate problem of the technical programmes issued by the Air Force Staff. A recent conference, held in Munich in October 1987, permitted us to deal with this problem and the relations between the technicians and the military in the development of these programmes. Some researchers, such as E. Chadeau, emphasised the mediocre way in which the specialist agencies of the French Air Force Staff worded the draft programmes. The Air Force officers in charge, who had received their training on the job, were themselves practical military men who had distinguished themselves during the Great War rather than engineers specialised in aeronautical technology.⁵⁴

If we analyse the development of the technical aeronautical programmes, it will be seen that, prior to 1933, they related to bombers, fighters, multi-seater, reconnaissance and observation aircraft, in other words quite distinct categories. In 1933, with the introduction of the BCR concept (bomber, combat, reconnaissance), an aircraft capable of penetrating enemy air-defences to drop its bombs on enemy territory and of engaging enemy interceptor-fighters, the Air Force was moving towards an aircraft *à la* Douhet which, as a result of subsequent technological advances, very soon became obsolete. Once more, in 1934, the technical programmes were modified to give birth to other categories: multi-seater bomber, single-seater fighter and three-seater light defensive aircraft. Finally, in 1936, another reform created four categories: single-seater fighters, three-seaters, bombers, transport aircraft.⁵⁵

If these modifications were decided upon in order to meet requirements such as the adaptation of the performance of French aircraft to that of the aircraft manufactured by her potential enemies - Germany and Italy - they nevertheless disrupted, through the rapid and successive changes that they brought about, the very design of the *matériel* programmes and their implementation. Finally, it would appear that, from the point of view of technical design, the orientation towards the BCR programme constituted a severe handicap in the *matériel* policy practised by the Air Force - a handicap which subsequently led to a great loss of time.

In response to the requirements of these technical programmes a certain number of prototypes were designed by industrialists. Emmanuel Chadeau emphasised that the design offices too often forgot that prototypes have to be studied before they can be built in large number. The mass-produced aircraft were constructed as identical copies of painstakingly developed prototypes, and these prototypes were themselves designed to meet requirements which had been determined without any thought for industrial construction.⁵⁶

Conclusion

The wide scope of our subject and the limited amount of space have meant that it has only been possible to shed some light on the problem of responsibility for military aviation policies in the two years preceding the war in France. The Riom Trial, during

which this responsibility was mentioned, presented an opportunity for a genuine settling of scores between politicians, industrialists, technicians and the military. The politicians put all the blame on the military, accusing them of having poorly defined the requirements and of having committed serious doctrinal mistakes. The industrialists and technicians also put all the blame on the military, accusing them of not having made the most of the opportunities with which the revived aeronautical industry had presented them in the period 1938–40. The military put all the blame on the politicians, technicians and industrialists, accusing them of not having provided them with the industrial and technical infrastructure required for their projects. Historians must thank the leaders of the Vichy regime, for the Riom Trial constitutes an inexhaustible source of documentation which enables them to make a very interesting comparison between the statements made by those involved in the drama of 1940, who had become witnesses for some and accused for others, and their pre-war actions.

What conclusions can be drawn from all these archives for our subject? The first is that responsibility for the technical and industrial policies pursued in 1938 and 1939 is shared by all the leaders, be they politicians, technicians or industrialists. Nobody can claim that he made no mistake at all, nor can anybody deny that he did not do his best to bring the rearmament of the Air Force to a successful conclusion. Certainly, Guy La Chambre gave extensive powers to General Vuillemin; but he also had considerable power and sizeable funds. Despite the enormous effort it made, the French aeronautical industry was not able to satisfy the requirements of the Air Force until it was too late. As for those responsible in the Air Force, caught up in the doctrinal contradictions of a service suffering from mental sclerosis, they were able neither to recognise the realities of modern warfare nor to adapt to them when they could have done so.

Notes

1. Statement made by General Vuillemin, cour suprême de justice, 27 July 1942, SHAA Z-11275. (Records from the *Service historique de l'armée de l'Air* are denoted by the acronym SHAA.)
2. Ibid.

3. Patrick Facon, 'Le Plan V (1938-1939)', *Revue historique des armées*, No. 4, 1979, pp. 102-23.
4. Arnaud Teyssier, 'Le général Vuillemin, chef d'état-major général de l'armée de l'Air (1938-1939). Un haut responsable militaire face au danger allemand', *Revue historique des armées*, No. 2, 1987, pp. 104-13.
5. See SHAA Z-11275.
6. See the fonds 'Laudocette' (archives Guy La Chambre) at the SHAA.
7. Anatole De Monzie, *La saison des juges*, Paris, 1943, p. 131.
8. *Ibid.*, p. 130.
9. Etude sur le plan V. Son origine, son élaboration, son exécution, rédigée par Guy La Chambre en vue du procès de Riom. SHAA Z-12930.
10. Arnaud Teyssier, 'Vuillemin', pp. 106-7.
11. General Vuillemin, member of the Supreme Air Council, to the Air Minister, 15 January 1938, SHAA Z-12949.
12. Arnaud Teyssier, 'Vuillemin', p. 108.
13. *Ibid.*, p. 108.
14. Robert Frankenstein, *Le Prix du réarmement français*, Paris, 1982, p. 263.
15. *Ibid.*, p. 264.
16. Second statement made by Vuillemin, 3 October 1940, SHAA Z-12964.
17. Emmanuel Chadeau, *L'industrie aéronautique française, 1900-1950*, Paris, 1987, p. 312.
18. Facon, 'Le plan V', p. 104.
19. *Journal officiel de la république française*, 6 March 1938, pp. 2621-2.
20. Facon, 'Le plan V', p. 105.
21. Pierre Cot, *Le procès de la République*, New York, 1944, p. 231.
22. *Ibid.*
23. *Ibid.*
24. General Vuillemin to the Air Minister, 15 January 1938, SHAA Z-12949.
25. *Ibid.*
26. *Ibid.*
27. Facon, 'Le plan V', p. 107.
28. Patrick Facon, *Le haut commandement aérien français et la crise de Munich (1938)*, Vincennes, 1987, p. 177.
29. General Vuillemin to the Air Minister, 15 January 1938, SHAA Z-12949.
30. P. Facon, *Le haut commandement aérien français et la crise de Munich (1938)*, pp. 177-8.
31. Report by the aeronautical inspector de Fouchier, 27 January 1941, SHAA 3 D493.
32. Report by the aeronautical inspector Chossat, SHAA 3 D 494.
33. *Ibid.*
34. De Fouchier report (note 31).
35. Robert Frankenstein, *Le Prix*, p. 262.
36. Emmanuel Chadeau, *L'industrie aéronautique*, p. 273.
37. Robert Frankenstein, *Le Prix*, p. 85.
38. See P. Facon, 'Le plan V', p. 107.
39. *Ibid.*
40. *Ibid.*
41. See P. Facon, *Le haut commandement aérien français et la crise de Munich (1938)*, p. 180.

42. Joseph Roos, 'La bataille de la production industrielle', *l'aire*, September 1971, p. 46.
43. Statement made by Vuillemin at Riom, 27 July 1942, SHAA Z-11275.
44. Statement made by Bergeret at Riom, 27 July 1942, SHAA Z-11275.
45. Ibid.
46. Statements made by Vuillemin at Riom, 27 July 1942, SHAA Z-11275.
47. Ibid.
48. Minutes of the meeting on 9 November 1938, SHAA 1 B 4.
49. 'La responsabilité du haut commandement français dans la sous-estimation du facteur aérien', by Guy La Chambre, SHAA Z-12967.
50. See the study by Arnaud Teyssier, 'L'appui aux forces de surface. L'armée de l'Air à la recherche d'une doctrine (1933-1939)', *Colloque Air*, 1987, Paris.
51. See the study by P. Fridenson and J. Lecuir, *La France et la Grande-Bretagne face aux problèmes aériens (1935-mai 1940)*, Vincennes, SHAA, 1976.
52. Statement made by Bergeret at Riom (note 44).
53. Ibid.
54. Yves Cohen and Klaus Manfrass (ed.), *Frankreich und Deutschland. Forschung, Technologie und industrielle Entwicklung im 19. und 20. Jahrhundert. Internationales Kolloquium, München, 12.-15. Oktober 1987. München 1990*, pp. 361-379.
55. Note on the technical programmes of the Air Force, n.d., SHAA Z-12934.
56. Emmanuel Chadeau, *L'industrie aéronautique*, p. 254.

9

Aeronautical Research in the Third Reich. Organisation, Management and Efficiency during Rearmament and War

Helmuth Trischler

The Expansion of German Aeronautical Research to 'Big Science'

After its take-over of power the Nazi regime could build on an aeronautical research which ranked at the international top level in all but a very few fields. The prohibition of military-related research by the Treaty of Versailles and the ban on building aircraft, in effect until May 1922, had further aided basic research, which had held a leading position in Germany since the turn of the century. Under the leadership of Ludwig Prandtl, Germany set the standards in aerodynamics and other basic disciplines. The Aerodynamics Research Establishment (Aerodynamische Versuchsanstalt-AVA), the successor to the Modellversuchsanstalt für Motorluftschiffahrt, founded in 1906-7, and its affiliate, the Kaiser Wilhelm Institute for Fluid Mechanics Research in Göttingen, were regarded as the Mecca of research in aerodynamics. The influence of Prandtl's Göttingen School was felt in scientific circles world-wide. The creation of modern American aerodynamics by one of Prandtl's students, Theodore von Kármán, is one of the most important examples of the transfer of scientific knowledge from Göttingen.¹ International esteem for its performance had enabled German aeronautical research to maintain and even intensify its contacts with the international scientific community, despite the boycott of German science initiated by the French.²

In some important engineering sectors, the prohibition of any research of military relevance, which was strictly enforced at

least until the Paris Agreements of May 1926, and the many years of construction restrictions together with a chronic shortage of funds, had caused German aeronautical research to drop below the level of the leading nations, especially in engine and propeller research, where the German Experimental Institute for Aviation in Berlin-Adlershof did not have the necessary expensive large equipment (test stands).³

The Deutsche Versuchsanstalt für Luftfahrt (Experimental Institute for Aviation), founded in 1912, was the other centre of aeronautical research, far bigger in terms of personnel and equipment. The much more application-oriented DVL enjoyed a similar international reputation to that of the AVA. But it had been hit harder than the AVA by the cut-backs in state subsidies during the world economic crisis. Although it enjoyed strong backing in the Reich Ministry of Transport, its 12-million-Reichmarks expansion programme approved by the Reichstag in 1928 and designed to keep up with rapid developments in international aeronautical research was cut back to a minimum.⁴ Grouped around the centres of DVL and AVA were the Scientific Group of the Rhön-Rossitten-Gesellschaft under Walter Georgii, dedicated to glider flying; the Wireless and Radio Experimental Institute (DVG) in Gräfelfing near Munich, founded in 1907 by Max Dieckmann, and a number of combined teaching and research departments at universities and colleges (Aachen, Charlottenburg, Darmstadt, Dresden, Berlin, etc.).⁵ Scientific co-ordination of these originally rather disorganised research activities was carried out by the German Aeronautical Research Council (Deutscher Forschungsrat für Luftfahrt) established in 1928 by Prandtl and von Kármán in conjunction with the Reich Ministry of Transport.⁶

However, the soul of the tremendous expansion of aeronautical research in the Third Reich was not Hermann Goering, who was incompetent in scientific matters, nor was it his Undersecretary, Erhard Milch, whose predominant interest was development and production. It was, in fact, the Head of Research in the Reich Ministry of Aviation, Adolf Baeumker. He had been involved in aviation since the First World War. As an aviation expert he had represented German interests in the Geneva disarmament talks, and, since 1927, as a branch chief with the Reich Ministry of Transport he had quite successfully managed to protect aeronautical research which had been organised on a private basis against the threat of nationalisation and further budget cuts.⁷ Except for a brief six-month interruption in 1941-2,

Baumker was in charge of government and ministerial support of aeronautical research, and thus ensured a remarkable degree of bureaucratic continuity. Goering's intention to give the Luftwaffe a key role, as being the decisive factor in a future war, gave Baumker the freedom he needed to realise his ambitious expansion plans.

The initial phase from February 1933 to the official establishment of the Luftwaffe in March 1935 was characterised by two overlapping developments. First, existing centres were expanded on the basis of concepts already formulated by the scientists some time previously. Only a few weeks after the rise to power of the Nazis the AVA was authorised to build a large wind-tunnel which it had been requesting in vain for five years.⁸

Glider research was removed from its place in the aerobatics environment by restructuring the Rhön-Rossitten Society into the German Glider Research Institute (DFS). Its location on military property in Darmstadt gives an indication of its future role. But above all the DVL was undergoing a process of expansion. The 'Expanded Improvement Programme for the Period 1932-1936' increased the funds from the original 1.4 million Reichmarks to a sum several times higher. By the start of the war, the Reich Ministry of Aviation had spent over 28 million Reichmarks on the DVL.⁹ With this change from a situation of a chronic shortage of funds to one of abundance, the second measure of those in power became easier to put up with: the deep trauma caused by the unification of the traditionally self-administering centres of research, all the more since the research centres remained private companies. The Scientific Society for Aeronautics (*Wissenschaftliche Gesellschaft für Luftfahrt* - WGL), a body of long-standing tradition, died a slow death until 1936. It was gradually replaced by the Association for Aeronautical Research (*Vereinigung für Luftfahrtforschung* - VLF). The VLF was subordinate to the Technical Office of the Reich Ministry of Aviation and designed to control research. It was a group of experts from science and industry, which was to ensure the transfer of scientific knowledge to aircraft manufacturers for practical application, because the Aviation Ministry felt that the lack of co-operation between research and development had been the main deficiency in aviation technology in the past. By appointing scientists to head the specialised working groups, the Ministry of Aviation took into account the ideas that 'research had to precede development' and that 'autonomous

research should retain adequate influence on the development of new aircraft'.¹⁰

Another innovation was the creation of the *Zentrale für wissenschaftliches Berichtswesen über Luftfahrtforschung* (ZWB) (Centre of Scientific Documentation for Aeronautical Research) in February 1933. The documentation system, which is so important for research, reflects the 'anarchic' origins of the scientific community prior to 1933. All of the numerous aviation organisations published their own periodicals, and the research institutes published their own reports. The new uniformity of the documentation system made it easier to keep track of the state of research.

It was not surprising that the scientists were so delighted by the unaccustomed flow of funds. Having barely been able to keep their laboratories afloat in the days of the Republic, they now discovered that there was no limit to the projects they could submit to the Ministry of Aviation. Previously the scope of their plans had been repeatedly reduced, but those now in power were obviously very much aware of the need to expand their research institutes in the interest of scientific progress. In the difficult years of the world economic crisis many scientists had become convinced that parliamentary institutions were unable to represent the interests of research properly. In the light of this experience the extensive interest in aeronautical research displayed by those now in power, especially in the first months after their take-over, made a pleasant change. The first official visits by Milch and other representatives of the political leadership of the Third Reich significantly upgraded the scientific standing of aeronautical research. The willingness with which the majority of researchers moved from the highly esteemed Scientific Society for Aeronautics to the newly founded VLF showed the regime that the scientific community would not resist the long-term objective of building a modern air force.¹¹

In March 1935, with the proclamation of German sovereignty of the air and the official setting-up of the *Luftwaffe*, the regime rid itself of the last shackles of the 'System of Versailles'. Goering's insistence that 'German aeronautical research will have to reach the production levels of the leading foreign nations at the latest by 1938 and then take the lead in several important areas,' heralded the beginning of the second phase of expansion of scientific centres.¹² At confidential meetings months earlier, leading researchers had been given an idea of the main areas of

the air-armament plans of the Reich. The Kaiser-Wilhelm Society had also been informed that they were to cede important responsibilities with regard to the AVA and its own Institute for Fluid Mechanics Research to the Aviation Ministry, primarily for reasons of secrecy.¹³ On 21 March 1935, Baeumker briefed Goering on the expansion of aeronautical research. After the Minister had given his general approval, Baeumker's plans were co-ordinated at several meetings with experts from the military, industrial and scientific community. In late April Baeumker submitted the results of the discussions in a memorandum, which served as a guideline for future developments.¹⁴ It specified four basic research priorities:

1. Germany was lagging far behind in aircraft-engine research owing to a fourteen-year period of neglect in this area. Along with research of a mainly practical application, 'long-term basic research was to be initiated as soon as possible', similar to that being carried out in Britain. New approaches were to be taken in materials research. If self-sufficiency were to be achieved new materials would have to be invented and developed for use in aircraft and engine production. This required far-reaching organisational changes. Fuel research was said to be better off. The method of adapting engine design to the fuels available in the Reich through co-operation with the chemical laboratories of the large manufacturers and 'general science' proved promising.
2. Only rapid progress in aerodynamics and studies of flight characteristics would improve aircraft performance and flight characteristics. It would be impossible to catch up on the progress which the US or Britain had made in the previous ten years without completely reorganising the provision of large equipment, especially wind-tunnels. Whereas other countries were operating many wind-tunnels, there was only one large wind-tunnel in Germany at the time.

The memorandum also drew conclusions from the emerging interdisciplinary changes of the time. Since the mid-1920s increases in speed and flight altitude had emerged as primary objectives, along with improved navigation. The terms of reference and the functioning of aerodynamics were thus put on a new footing.¹⁵ Germany would have to face this change offensively. The prerequisites for this development and its impact on engineering would have to be defined. Flight characteristics were to be determined in advance at a

theoretical level by research into contact surfaces and at a practical level by tail-spin testing.

3. The improvement of radio navigation and instrument flying demanded close co-operation between researchers and industry and the Luftwaffe development and testing centres. It was to be precisely in this area that basic data were to be compiled to ensure Germany's superiority over other countries.
4. While the above objectives would also benefit civil aviation, the demand for aircraft-armament research was strictly in the interest of the military. Leaving the initiative to industry and the military authorities only would arouse scepticism. Actual achievements failed to satisfy the requirements of the Reich Ministry of Aviation. There was a need for far more generous support, beginning with the recruitment of qualified personnel, to speed up the expansion of research facilities.

In the face of opposition from leading representatives of the DVL, who thought that the concentration of new facilities in Berlin-Adlershof would be more efficient, a highly advanced research centre was designed from scratch in Brunswick. As neither the DVL nor the AVA could be extended any further, and since they could hardly be protected against air raids because of their location in the urban areas of the city, a spacious new location with its own airfield was the logical answer. Hermann Blenk, the director of the Deutsche Forschungsanstalt für Luftfahrt, which was officially founded on 10 February 1936, pointed to another important reason for locating the DFL outside Brunswick. The intention 'of combining armament research and gas dynamics' made the location away from densely populated areas mandatory.¹⁶ Within a few years the DFL grew into a huge research centre. Baeumker hit the nail on the head when he stated early in 1942 that the DFL was the largest research project realised so far.¹⁷

The problem area of the rapid expansion of aeronautical research was not the equipment – the cost of building the DFL alone was put at 15–20 million marks¹⁸ – but personnel. On account of their strictly regulated scales, research institutes could not compete with the rapidly expanding industry for qualified engineers and with the universities for scientists. There were numerous complaints from boards of directors about their best-qualified employees being lured away. Expansion of the staff by several times its original number during the period prior to the take-over led to problems. The head of the AVA,

Albert Betz, complained that they were forced to hire poorly trained personnel, who, at first, were more of a hindrance than a help.¹⁹ Since a preliminary estimate indicated that existing centres had to provide the DFL with 300 additional engineers, there was the danger that scientific performance might be paralysed for years. As Friedrich Seewald of the DVL rightly pointed out, the DFL withdrew more intellectual talent from aeronautical research in the medium term than it was able to return.²⁰ Many of its institutes were still expanding until well into the war and thus, from a scientific point of view, unproductive.

Signs of a crisis also began to appear in other areas, forcing the bureaucrats in the Aviation Ministry to reassess their expansion plans. The establishment of the VLF as a joint management authority for both science and technology proved to be a considerable failure. By 1935 at the latest it had become clear that the problem about which there had been so many complaints in 1933, the lack of co-operation between science and technology, was still unresolved. There had not even been satisfactory co-ordination of the research areas of the individual centres. But above all, the Aviation Ministry had failed completely to achieve its objective of making aeronautical research an area encompassing science, technology and industry, a fusion of German scientific tradition and modern research methods, which would show the whole world 'the creative capabilities of the German mind'.²¹

If manifestations of National Socialist missionary zeal are reduced to their basic message, it becomes clear that German aeronautical research in the mid-1930s had reached a new stage not only in terms of quantity but also in terms of quality. The history of science states that the transition to 'big science', large-scale research as an innovative form of organising research, began with the Manhattan Project, the construction of the atom bomb.²² In contrast, it should be noted that the constituent elements of 'big science' were already becoming evident with the build-up of the Luftwaffe after the mid-1930s: research was being determined by equipment (wind-tunnels and test stands),²³ funding came primarily from government sources, the government set priorities while research establishments enjoyed a wide freedom, the research establishments were independent of the universities, a wide variety of scientific disciplines and research teams were united in a one common aim (interdisciplinary research) and, as a consequence, there was a hierarchical organisational structure. The decade between

1935 and the end of the Second World War provides an opportunity to study the attempts to solve problems of innovation in large-scale research in the dialectics of a dictatorial and polycratic state.²⁴ The rapid modernisation of organisational structures and the political control of science and research prompted by this constellation appears to be due not so much to efforts to modernise in the Third Reich²⁵ as to the challenges of large-scale research. The new demands on science to solve problems interacted with the structural problems involved in the political control of social processes to create an 'organised chaos' of competing authorities.

To ensure that aeronautical research would play a leading role in cultural and scientific life, the Ministry of Aviation developed a multitude of concepts in the mid-1930s. The head of the Research Department of the Ministry of Aviation, Adolf Baeumker, was all too familiar with the power structure in the Third Reich, and knew that he had to get Goering's backing to implement his ideas, which would virtually revolutionise German science. One idea was designed to stop the exodus of highly qualified scientists to the universities and industry. Baeumker suggested to Goering that he should establish so-called 'Reich professorships', with a view to upgrading the pay of the heads of department of the research centres. Fifty such professorships would be sufficient to meet the requirements of the next few years.²⁶ Having received Goering's approval, Kesselring, as head of the Luftwaffe Administrative Office, began negotiations with the Reich Ministry of Finance. When the question of eligibility of these research professors for retirement benefits arose, consultation with the Reich Ministry of Education could no longer be avoided. As a matter of form, the professorships were included in the budget of the Ministry of Education, for the Berlin College of Technology. But this was exactly the situation the Ministry of Aviation had sought to avoid. The Ministry of Education was unwilling to act as an accessory and insisted on participating in the evaluation of the qualifications of prospective candidates for university teaching. But the Ministry of Education²⁷ had eventually to acquiesce in the face of the Ministry of Aviation. The Ministry of Aviation always regarded proposals from the Education Ministry as nothing more than arbitrary suggestions. In the process of establishing large-scale research Baeumker brought the role of innovation to the point when he explained:²⁸ 'Establishing modern research capabilities that will have to meet the exacting

demands of industry cannot be achieved with the methods that proved effective in the old days when science was self-sufficient.'

The VLF, set up within a few weeks of the take-over, could not keep pace with the expansion of aeronautical research into the biggest German research organisation. When the WGL, which had continued to take care of the representative tasks of aeronautical research, decided in spring 1936 to close, the process of bringing individual aeronautical organisations under one wing was complete. The many independent associations were replaced by one single organisation, the 'Lilienthal Aeronautical Research Association'. The fact that Carl Bosch, president of the Kaiser-Wilhelm Association, Prandtl and Baeumker became members of the board, illustrates the immense prestige which aeronautical research had won within a few years. International attendance at the ostentatious annual conventions was surprisingly large. By 1938 German aeronautical research had been integrated into the international scientific community. 'For political reasons'²⁹ the Ministry of Aviation placed particular emphasis on contacts with the Anglo-Saxon countries. Only when international tension grew in the wake of Hitler's revisionism, was international participation in the Lilienthal Association reduced to that of the Axis powers.³⁰

The finishing touch to the reorganisation was the 'German Aeronautical Research Academy'. In early April Baeumker, who was an expert at playing on Goering's vanity, informed him of his intention to make the best scientific tradition available to aeronautical research by fusing the arts and sciences with technology. In his excursus on the history of academies he addressed the important role of the princes in founding them. He showed the Minister photocopies of documents and decrees on the ruler's provisions for the academies. Goering was very impressed, and in an effort to build up the prestige of the academies he himself would become president and provide 'government estate and other property'. Kesselring was to submit concrete plans as quickly as possible.³¹

With Goering's patronage, it was possible within a few weeks to overcome all the obstacles standing in the way of the historically unique Academy of Technical Sciences. Early in July a constitution bearing a close similarity to that of the Prussian and Bavarian Academies of Science was agreed upon. The only unconventional aspect was the acceptance of subscribing members. The academy was to counter the danger of over-

specialisation, which would have meant the end of aeronautical research.³²

Even if the research workers of the Allied countries had ceased to participate as full or corresponding members at the latest by the start of the war, the Academy was able to continue its work at a high scientific level. Baeumker, as its director, was always on his guard, and ensured that the Academy 'remained autonomous in its decision-making' and that 'outside pressure regarding its expansion and management was always repulsed with the help of sound evidence'.³³ Paradoxically, it was just the leader principle that saved the Academy from the latent threat of intervention by competing authorities. With Goering as President and Milch as Vice-President, the Academy was strong enough to maintain its scientific autonomy without much interference even during the war.

Decentralisation remained a characteristic of aeronautical research. Three basic organisational patterns can be found:

- 1 An existing research team served as the organisational core around which a diversified research centre was built. At the constituent meeting of the Lilienthal Association in October 1936, Bosch announced that one of the main locations of aeronautics research in the future would be Stuttgart. Towards the end of the year, efforts to found the Graf Zeppelin Research Institute (FGZ) were stepped up. In expanding the Aeronautical Department of the Stuttgart College of Technology this private foundation was created at Ruit near Esslingen.³⁴ The FGZ quickly expanded under the skilled management of Georg Madelung into an innovative research centre.³⁵

In the case of the Oberpfaffenhofen Air Radio Research Institute (Flugfunkforschungsinstitut Oberpfaffenhofen - FFO) the DVG was the nucleus of the new research centre. In 1936, Max Dieckmann, the head of the DVG, became full professor at the newly founded Department of Radio Technology and Aircraft Radio Technology of the Munich College of Technology. As early as September 1935 Baeumker had given him the task of drawing up plans and estimates for a new aircraft radio research centre. It was a surprise even to him that the giant plan, which even he himself had regarded as utopian, was nevertheless accepted. The special interest of the Ministry of Aviation in aircraft radio research stemmed from a lack of overall governmental planning and control of research under the National Socialist regime and the polycratic in-fighting. Since part of the

DVL department of electrical engineering and radio communications had been transferred to the Luftwaffe Testing Ground at Rechlin in 1935, Baeumker modified his original plan of expanding aircraft radio research under the auspices of the DVL. The Aircraft Radio Research Institute was thus made an independent association located on the new Dornier airfield at Oberpfaffenhofen. The Gräfelfing Experimental Institute was made the sponsor organisation and provided the necessary personnel and expertise. Between February and September 1937 the new staff was moved to Oberpfaffenhofen.³⁶

Dating back to the Gräfelfing period were the three most important projects, which had reached the testing stage by 1937: the problems of a high-altitude altimeter, self-excitation and FM direction-finding. When the war broke out, work on projects of less military relevance, such as a remote ranging system, had to be halted. With the 'development freeze' it became more and more difficult to conduct basic research. The fast-growing institute found itself fully engaged in work on locating and navigating equipment for the Luftwaffe, an area that was becoming increasingly important as the war progressed. The freedom to conduct more basic research continued to dwindle. This short-sighted orientation to quick application was definitely not a minor reason for the fact that high-frequency research was one of the few sectors where Germany was lagging behind international standards in aeronautics-related research in 1945.³⁷

2 In addition to the DFL, the Munich Aeronautical Research Institute (Luftfahrtforschungsanstalt München – LFM) was designed completely from scratch.³⁸ Political, military and scientific considerations and reasons connected with the structure of industry favoured the creation of research establishments in the south. Southern Germany, with Messerschmitt, Dornier, *et al.* was becoming a new centre of the aircraft industry. The annexation of Austria gave the south more political weight in the Reich. On the eve of the Second World War a revolution in engine technology seemed imminent. Test stands and wind-tunnels that went far beyond the size and performance of those in use up to that time were required to study the special engines most suited to the needs of military (jet and rocket propulsion).³⁹ Power-supply for large wind-tunnels with an effective diameter of 8 m proved to be the structural problem which predetermined the location of future research facilities. The techniques of aeronautical research had become a 'big science'.

The Munich metropolitan area, with its nearby reservoirs for the generation of electricity, seemed to be a logical choice.

Planning began in 1939. The LFM was established during the war years. Although Baeumker had adopted the LFM as his new favourite and given it the necessary priority, construction of the main experimental facilities at Ottobrunn and in the Ötztal was slow. Paradoxically, attempts were made to compensate for construction delays with plans which were always increasing in their scope. At the end of the war the LFM was the fragment of a monumental research centre that had in fact never reached the stage of practical scientific work.

3 The annexations during the phase of appeasement and the territorial gains of the blitzkrieg brought important research institutes which were still operational under German control. Chalais Meudon in France and the National Aeronautical Laboratory in Amsterdam were assigned to the DFL and AVA respectively. In both cases, it appears, they were content to hand over their research facilities to the Germans while retaining the scientific staff. The AVA successfully forestalled attempts by several Party agencies to take over the Amsterdam laboratory completely, and it protected Dutch scientists.⁴⁰ French facilities were controlled by the Paris Field Office of the DVL. In general, the attitude towards the annexed centres reflects the overall pattern of the German policy of occupation. The centres in the East, like the Aeronautics Research Institute in Prague, were annexed; while with those in the West it was found sufficient to make their scientific potential available to German interests.

Research Management in the Second World War

When expanding aeronautical research the National Socialist regime relied on non-state-controlled organisations which had proved successful since the days of the Empire. In the pluralistic Weimar Republic, the independence of research had not been disputed. After the take-over, however, there was no question of mediatising research by reorganising the centres into Reich institutes. The scientists proved their loyalty by co-operating in the VLF and subsequently in the Lilienthal Association, thus obviating the need to 'nationalise' research. The regime was content to introduce the *Führerprinzip*. The heads of the institutes had to follow instructions. However, their terms of refer-

ence and actual work continued to follow the traditional rules of the scientific community. The Technical Office, or more especially the Research Division, of the Ministry of Aviation only had to ensure that 'the requirements of development, testing and procurement were given sufficient consideration in work programmes'. Intervening in the research process itself was to be carefully avoided. The department was to confine itself to setting tasks and controlling the work and any expenditure incurred.⁴¹ To avoid duplication of effort, a task committee was established in May 1937 when the DFL first began its scientific work, but it was nothing more than a modified version of the Deutsche Forschungsrat für Luftfahrt, which had been dissolved in 1933.⁴²

In modern science policy, the duality of guidelines laid down by politicians and extensive freedom to carry out practical research is referred to as 'global regulation', and is applied to large-scale research.⁴³ The Ministry of Aviation's research management already had many of the characteristics of modern global regulation.⁴⁴ On the other hand, the vague compromise between political control and freedom to research provided the possibility of a shift. The polycratic plurality of the concepts of organisation both at the national level and within the Ministry of Aviation did not guarantee the continued independence of aeronautical research. The creation of a Reich Research Council by the Ministry of Education in 1937 and the establishment of a 'science' division within the Supreme Command of the Wehrmacht in October 1938 did little to influence aeronautical research.⁴⁵

The continuing loss of responsibility of the Research Division in the Ministry of Aviation was more serious.⁴⁶ Baeumker's department was being insidiously deprived of power, and this had fatal consequences for research. Baeumker had always guaranteed the freedom to research and the primacy of basic research over application-oriented research.⁴⁷ Intra-ministerial rivalries within the Technical Office of the Ministry of Aviation resulted in the responsibilities for decision-making being shifted from research to development. When in 1937 the head of the Research Department was deprived of direct access to the Minister, intra-ministerial resistance to the previously strong position of research gained ground. Allegations of inadequate co-operation between science and industry could always be used to curb the freedom to research and counter the priority given to basic research.

The scientists saw in the changing power-structures within the Ministry of Aviation a revival of bureaucratic impediments. The head of administration at the AVA drew the conclusion that 'the whole research establishment cannot be integrated into a ministerial administrative apparatus, and it is imperative that the Research Department be converted into an independent research institute'.⁴⁸

During the Second World War, aeronautical research, already deprived of some of its bureaucratic support, continued to fall behind. Ernst Udet, chaotic head of the Technical Office,⁴⁹ favoured the advocates of a clear precedence of development over research. The research community had to supply not only the front but also development departments with badly needed specialists. The Chief Engineer, Roluf W. Lucht, could point to the real shortage of engineers in industry, a fact which jeopardised the availability of critical equipment, when he demanded the release of qualified personnel from the research establishments.⁵⁰ Baeumker's urgent warning that research activity would fall irredeemably behind enemy countries unless there was a radical change of policy, bore little fruit.⁵¹ On the contrary, in October 1941 the Research Department was placed under the control of the Development Department, and thus the claim made in 1933 that aeronautical research was the leading, revolutionising branch of all fields of science and technology had become absurd.⁵²

At the end of 1941 Baeumker calculated the loss of ground by aeronautical research in scientific life. Since the take-over, it had had no say in organisational matters relating to overall research, while the Supreme Command of the Wehrmacht, with Erich Schumann as Head of the Science Department, had exerted great influence. Even Goering's order given in June 1941 to make the head of aeronautical research a member of the Reich Research Council had been ignored. The only positive point was Milch's election to the Senate of the Kaiser-Wilhelm Association. Being the largest, most modern and most extensive area of research aeronautical research was well ahead of the Kaiser-Wilhelm Association, which had little to show in the field of natural sciences. Compared to research in the other services of the Wehrmacht, it was definitely in a class by itself. The purely authoritarian management of research 'by biased individuals' had failed and had to be changed.⁵³

With regard to his unequivocal exposure of the crisis in aeronautical research Baeumker had chosen his time and his

audience well. By the end of 1941 the failure of the air-armament programme could not be covered up any longer. Ernst Udet's suicide in November 1941 cleared the way for reform. Milch was given a free rein by Goering and proceeded to draw up a systematic plan for aircraft production.⁵⁴ Baeumker's essential aim was 'to re-establish a single authority over aeronautical research, which would issue instructions to all the branches of this extensive field'. His proposal to place a scientist at the top of a steering committee was somewhat problematic. It was an admission of the failure of the politico-bureaucratic management of research. The Technical Office had neither succeeded in establishing specific research objectives nor in consolidating R & D organisations, on the basis of the American National Advisory Committee for Aeronautics (NACA). The head of the FGZ, Georg Madelung, criticised the bureaucrats' total lack of understanding of research. Senior officials at the Ministry of Aviation failed completely to establish the technological and scientific problems. The Technical Office viewed research institutes as 'aesthetes, outsiders and eccentrics'. If all the aeronautical research facilities were destroyed by bombs from one day to the next the Ministry of Aviation could easily proceed with development in co-operation with industry and still not neglect a single area.⁵⁵

Madelung's complaints about the failure to consult researchers about remedying acute deficiencies in the armaments industry reflects the prevailing attitude of German aeronautical researchers, which can be defined as a disposition to self-mobilisation. Like Fritz Haber and others, who had put their scientific capability at the disposal of 'national defence' in the First World War, the leading aeronautical researchers identified themselves with the fighting front in their criticism of specific actions of the regime. They produced a wealth of ideas on improving the transfer of know-how to the development and production of new weapon systems, but they rarely fell on fertile soil in the context of the general chaos in air armament. It is thus no wonder that leading German scientists agreed to take over the management of research, despite their discomfort about neglecting their scientific work.⁵⁶

After months of discussion events unfolded in quick succession in early June 1942. On 5 June agreement was reached with Milch on the 'Research Management Board of the Ministry of Aviation', a body designed as a quatuorvirate which was authorised to deal directly with all the branches of the Ministry of

Aviation and the other high-ranking Reich authorities. Seewald, as head of the Berlin Office which replaced the previous Research Section, had direct access to the Undersecretary of State. Attendance at conferences of the Luftwaffe Director-General of Air Armament provided him with some insight into the main aspects of air armament. Prandtl, chairman, took over the representative functions, while Georgii became his deputy. Baeumker was given responsibility for administrative questions.⁵⁷

A few weeks later a crucial meeting on the future organisation of overall research was convened. Goering had already been directed by Hitler in mid-1941 to remodel the inefficient Reich Research Council in Rust's Ministry of Education. Goering felt that the newly created Research Council was to revolutionise research management in the same way as the Four-Year-Plan had previously revolutionised economic planning.⁵⁸ It remains to be seen to what extent the polycratic National Socialist system, combined with Hitler's indifference and incompetence, precluded nation-wide management of research in terms of structures and planning. The new Research Council was doomed to failure right from the start because the Ministry of Aviation would not relinquish its research responsibilities to any higher authority, even if it were chaired by Goering.⁵⁹ This exclusive position in aeronautical research, which was made up of many specialised disciplines, was a contradiction in itself.

As a result of these contradictions, difficulties soon arose. As the deficiencies of the Luftwaffe became increasingly obvious in mid-1942, research came under pressure from several sides. One of Goering's first measures as President of the Reich Research Council was to appoint a special commissioner for high-frequency research, Hans Plendl. This was specifically designed as an 'experiment for similar cases'.⁶⁰ Research management, well aware that its two institutes for high-frequency research especially had come in for some criticism from industry, tried to foster good relations with Plendl. In an effort to compensate for the superiority of Allied bomber forces over German fighter defence, due mainly to progress in radiometry, the electronics industry proposed to take over the FFO and the high-frequency research institute of the DVL. Research management had to muster all its political influence to repulse this combined thrust of industry and the Ministry of Aviation, which was intended to set a precedent. It was only on account of Milch's backing that researchers were not forced to give up exactly those areas which were becoming increasingly important to the war effort, for,

with Daimler-Benz in the lead, the engine industry was ready to assume control over engine research.⁶¹

In the latter half of 1942, a situation was developing which brought comprehensive research management to the point of absurdity. The latent shortage of qualified personnel and technicians intensified the competition between research and industry for personnel. Industry began to save its intellectual capital, its 'most valuable asset for the future' for the post-war period, which was beginning now to take shape.⁶² In this respect, industry was well ahead of research, as the latter waited the last months of the war before attempting in co-operation with the Osenberg Office to save its key personnel for reconstruction.⁶³ This, combined with the traditional rivalry between the services and SS's monopolising of more and more fields of research, ended in a race for manpower. Aeronautical research, losing political support on account of Goering's unstoppable decline, frequently got the wrong end of the stick. During 1943 complaints by institute heads about the enticing away of entire staffs piled up.⁶⁴ The shortage of manpower dating back to the 1920s was now critical, and further encouraged internal rivalry among scientists.

The reorganisation of research management in mid-1942 had done nothing to solve structural problems. There was still concern about co-ordinating the research programmes of the individual institutes so as to avoid duplication of effort and ensure effective use of funds. Research was still awaiting a concrete work programme tailored to the needs of air armament. The surfeit of problems facing research revealed past failures, if one considers that as late as September they were still discussing questions relating to the charter.⁶⁵

The experiment giving scientists full responsibility for their area of research proved advantageous to the regime despite troublesome personal conflicts (the animosity between Seewald and Baeumker stretched Prandtl's skills as a mediator to the limit in an effort to keep research management functioning). The research managers reciprocated Milch's trust in them with their self-mobilisation for the aims of the regime. Prandtl's awareness of the responsibility of his position, which he owed to the politicians, prevailed over his open resentment of his bureaucratic and representative functions.⁶⁶

Seewald and Georgii went as far as switch sides, changing from advocates of freedom to research into disciples of political control. They demanded the highest concentration on priority

tasks, without any consideration for existing working-groups. Freedom to research was to be sacrificed to the politicians' desire for the quick application of research results. The requirements of the front were to set the standard for research. 'Our only requirement is that research should fulfil its duties in this critical time of war' was how Georgii put the new credo of the scientists.⁶⁷

Since August 1942 work was under way on a concept which, to Prandtl and his colleagues, promised 'to improve the efficiency of research'. In May 1943 the new management and control system was finalised. From the experts most intimately acquainted with the specialised areas representatives were selected, who were in turn consolidated into groups led by senior experts. Their main priority was to implement the transfer of research results to air-armament production in co-operation with industry and the development agencies.⁶⁸ However, they had to begin with a survey of the individual subject areas to determine the state of affairs.

The survey submitted in July 1943 was clear enough about the efficiency of the current research planning. With the exception of aerodynamics as the genuine discipline of aeronautical research, there was a general lack of co-ordination between groups working in parallel. The most serious deficiencies were found in precisely those areas the research managers had identified as key areas: engine, high-frequency and weapons technology.⁶⁹ Besides the self-criticism of the scientists for their failure to adapt their research to War Requirements, the desolate air-armament situation was attributed to three major problem areas:

1. The scientists had repeatedly pointed out the dangers of the secrecy regulations, but in vain. The secrecy regulations, tightened at the beginning of the war, not only obstructed exchanges between scientists but were also the main obstacle to co-ordination of work programmes. Only in mid-1943 did the government and the military acknowledge that the excessive secrecy regulations had done more harm than good, and relax some of the restrictions.⁷⁰
2. Periodic drafting deprived research of irreplaceable key personnel, as shortage of personnel resulting from the transfer of engineers to industry and development agencies meant that whole programme areas at the institutes had to be suspended. Contrary to the situation in the First World War,

increases in personnel lagged hopelessly behind the expansion of facilities, so that in 1944 Betz came out in favour of an increase in the number of specialists by a factor of five. Compared to this, the partial success of the recall campaigns of the Osenberg Office was no more than a drop in the ocean.⁷¹

3. The group of scientists working in application-oriented areas complained fiercely about the lack of contact with the front. The example of the First World War served to drive home the point. Madelung emphasised that the efficiency of aeronautical research between 1914 and 1918 had been due to realistic and practical work, while at present any request for contact with the user ran into 'the Chinese Wall of divided responsibilities'.⁷²

Efficiency of Research for the Air War: A Summary

Research in the Second World War was indeed completely isolated from the front, which meant that researchers remained in ignorance of the practical application of their research and also of any developments required by the military.⁷³ Only where personal contact between scientists and generals managed to bridge the gap made by the political leadership did they succeed in convincing the Luftwaffe 'that scientists are quite open-minded people with whom one can indeed discuss tactical problems, new methods of attack and defence'.⁷⁴

The crux of the inefficiency of aeronautical research was not a lack of 'leader(s) in the best scientific tradition'.⁷⁵ On the contrary, in Georgii, who succeeded Seewald as director of Research Management, aeronautical research had an excellent organiser. By resuming the practice of meetings of the heads of institutes, designating 'special custodians' at the individual institutes and establishing special committees, he succeeded in the final year of war, despite increased communication problems, in improving the co-ordination of research and in concentrating some of the manpower on 'critical war projects'.⁷⁶ Low standards of scientific research were not to blame either. A Canadian committee of inquiry, upon conclusion of its work, was unequivocal about 'the high standard of German aeronautical research'. The Americans also vouched for the excellence of the research.⁷⁷ Undoubtedly, some scientists tended to withdraw to their ivory tower, although rarely for political reasons.⁷⁸

On the whole, however, self-isolation was more than compensated for by self-mobilisation.

The crux could be found, first, in the weaknesses inherent in the National Socialist system: for example, in the polycratic power-structures, which made the management of aeronautical research with its dependence on other areas of science practically impossible; and second, in the secondary rank of research on the socio-political scale of values and in the dominant role of the military, which was especially pronounced with Goering.

A glance beyond the German border is revealing. The international growth of aeronautical research reflects the increased importance of science in the economy and the closely related development of a properly functioning system of research management. The fact that for the first time in history there was large-scale research in aeronautics on the eve of the Second World War confronted not only the Third Reich with hitherto unknown science management problems. In Britain, too, there was inadequate linking of research and production, and the coexistence of many autonomous management bodies impeded centralised management. The British research system was based on the Department of Scientific and Industrial Research founded in 1915. When in October 1942 Wilfrid Freeman was appointed to the Air Ministry and in January 1943 Ben Lockspeiser was made Director of the Scientific Research Department in an attempt to improve relations between research and industry, it became clear that in Britain too the traditional management instruments could no longer satisfy the requirements of modern air armament.⁷⁹

The United States was the most successful in coming to terms with the integrated large-scale technology required by the air forces. The National Advisory Committee for Aeronautics, which reported directly to the President, countered, from 1939 onwards, the threat of the 'aeronautical superiority of Germany' with reforms in personnel and organisation. Roosevelt's appointment in 1941 of the NACA chairman, Vannevar Bush, as chairman of the National Defense Research Committee – shortly afterwards renamed Office of Scientific Research and Development – was the go-ahead for 'the mobilisation of the brains' and the successful transfer of research results to aircraft production.⁸⁰ It is characteristic that, with its experience in managing air armament, the United States was able to take the lead in epoch-making nuclear research.

This comparison puts the virtually unanimous criticism of the

inefficiency of German aeronautical research into perspective.⁸¹ Seen internationally, there are many indications that the United States, not Germany, was a special case. From a national perspective, Mehrtens is not being unreasonable in concluding from his analysis of science in the Third Reich that the Luftwaffe research effort was 'the most comprehensive and probably also the most effective one'.⁸²

Notes

1. Cf. Paul A. Hanle, *Bringing Aerodynamics to America*, Cambridge, Mass., 1982; Roger E. Bilstein, *Flight Patterns, Trends of Aeronautical Development in the United States, 1918-1929*, Athens, GA, 1983, p. 101. On the AVA cf. Julius C. Rotta, 'Die AVA. Zur Geschichte der Aerodynamischen Versuchsanstalt Göttingen', in *Luftfahrt International*, 1982, pp. 441-8 and 1983, pp. 29-34; Cordula Tollmien, 'Das Kaiser-Wilhelm-Institut für Strömungsforschung verbunden mit der Aerodynamischen Versuchsanstalt', in Heinrich Becker (ed.), *Die Universität Göttingen unter dem Nationalsozialismus. Das verdrängte Kapitel ihrer 250 jährigen Geschichte*, Munich, 1987, pp. 464-88.
2. Cf. Brigitte Schroeder-Gudehus, 'Deutsche Wissenschaft und Internationale Zusammenarbeit 1914-1928', Diss., Geneva, 1966.
3. Cf. Joachim Brämer, 'Die Deutsche Versuchsanstalt für Luftfahrt. Ein Beitrag zur Geschichte', in Karl Stuchtey and Walter Boje (eds.), *Beiträge zur Geschichte der deutschen Luftfahrtwissenschaft und -technik*, Vol. 1, Berlin, 1941, pp. 167-362; with some errors, Edward Homze, *Arming the Luftwaffe. The Reich Air Ministry and the German Aircraft Industry*, Lincoln, Nebr. - London, 1976, p. 28.
4. Brämer, *Versuchsanstalt*, p. 181; in detail in BA, R 2/5630 and 5644-5648.
5. Cf. Walter Georgii, 'Die Deutsche Versuchsanstalt für Segelflug. Ein Beitrag zur Geschichte', in Stuchtey and Boje (eds.), *Beiträge*, pp. 365-93, and Max Dieckmann, 'Die Münchener Institute für Flugforschung. Ein Beitrag zur Geschichte', *ibid.*, pp. 395-459.
6. Cf. Adolf Baeumker, *Zur Geschichte der deutschen Luftfahrtforschung. Ein Beitrag*, Munich, 1944, p. 19; in detail Archive of the Max-Planck-Institut für Strömungsforschung (MPI-Archiv), Deutscher Forschungsrat für Luftfahrt I-IV, and Historisches Archiv der DFVLR/Forschungszentrum AVA (HA-DFVLR/FZ-AVA), official correspondence.
7. HA-DFVLR, N1 Baeumker, Lebensbericht Baeumkers, manuscript of 14 July 1966; HA-DFVLR/FZ-AVA, *laudatio* by Prandtl for Adolf Baeumker's 50th birthday on 14 July 1941. On the threat of complete state control, cf. BA, R 2/5643, memo for record, 9 Jan. 1933.
8. Archive of the Max-Planck-Gesellschaft (MPG Archives), I. Abt. Rep 1 A/1508 p. 17; Prandtl to Telschow on 11 Feb.; pp. 31-4 Prandtl to Kaiser-

- Wilhelm-Gesellschaft on 10 Mar.; p. 44, Prandtl to the same, 18 Mar. 1933.
9. HA-DFVLR, audit reports, Prüfungsbericht der Deutschen Revisions- und Treuhand-AG, 31 Mar. 1940.
10. BA-MA, RL 3/233, Die Vereinigung für Luftfahrtforschung; BA-MA, RL 3/233, Die Vereinigung für Luftfahrtforschung; Adolf Baeumker, *Zur Geschichte der deutschen Luftfahrtforschung. Ein Beitrag*, Munich, 1944, p. 29.
11. In aeronautical research, the populist element of the National-Socialist ideology of science was unanimously rejected; Prandtl's objections to 'German Physics' are a typical example of the years 1941-42 (MPI Archive, records on theoretical physics). It was rather the presentation of research as a 'national responsibility', as 'a service to the nation', that acted as the integrating force; cf., in general, Herbert Mehrrens, 'Das "Dritte Reich" in der Naturwissenschaftsgeschichte; Literaturbericht und Problemskizze', in Herbert Mehrrens and Steffen Richter (eds.), *Naturwissenschaft, Technik und NS-Ideologie. Beiträge zur Wissenschaftsgeschichte des Dritten Reiches*, Frankfurt a.M., 1980, pp. 15-87, p. 47.
12. Baeumker, *Zur Geschichte*, p. 31. This phrasing corresponded to military planning, according to which the initial build-up of the Luftwaffe was to be completed by 1938/9, and it was to be ready for war after another five-year period to 1942/3; cf. Overy, *Göring*, p. 286. Like the military, Baeumker did not expect a war before about 1947/8. The final Luftwaffe build-up was therefore timed to end at that time.
13. MPI Archiv, Ministry of Aviation, minutes of the 3rd meeting of the Ministry of Aviation with the heads of research institutes on 25 Jan. 1935; MPG Archiv, I. Abt. Rep. 1 A/1477 p. 263, memo for record by Telschow, 16 January 1935.
14. MPI Archiv; Ministry of Aviation, streng vertraulich, Vorschläge für die künftige Ausgestaltung der Luftfahrtforschung, 25 Jan. 1935; also cf. HA-DFVLR, N1, Baeumker, proposals of Baeumker to Milch on measures to improve the organisation of German aeronautical research, 15 Mar. 1933.
15. Cf. Seewald's presentation at the 20th annual convention of the DVL on 20 Dec. 1935 (MPG Archiv, Rep. 1 A/1525, pp. 90-4, overview by William F. Durand (ed.) *Aerodynamic Theory. A General Review of Progress*, Berlin, 1934-6.
16. Herman Blenk, 'Die Luftfahrtforschungsanstalt Herman Goering', in Shich-tye and Boje (eds), *Beiträge zur Geschichte*, Vol. 1, pp. 463-561, p. 465.
17. HA-DFVLR, N1, Baeumker (copy); Baeumker to Blenk, dated 7 Jan. 1942.
18. MPI Archiv, VLF, memo for record by Baeumker on a meeting of 14 May 1935.
19. MPG Archiv, I. Abt. Rep. 1 A/1488 p. 182-185, Betz's report for meeting of the board of the AVA on 29 Oct. 1935.
20. MPI Archiv, Forschungsführung I, Seewald to Prandtl of 14 January 1943.
21. Baeumker, *Zur Geschichte*.
22. G. Radnitzky and G. Andersson, 'Wissenschaftspolitik und Organisationsformen der Forschung' in Alvin M. Weinberg, *Probleme der Großforschung*, Frankfurt a.M., 1970, pp. 11-14; Wolfgang Cartellieri, *Die Großforschung und der Staat. Gutachten über die zweckmäßige rechtliche und organisatorische Ausgestaltung der Institutionen für die Großforschung*, Part 1, Munich, 1967, p. 61. Peter Lundgren et al., *Staatliche Forschung in Deutschland 1870-1980*, Frankfurt a.M.-New York, 1986, pp. 137-44, date the birth of big science in

- Germany from the foundation of the first nuclear research centres, while the material presented rather contradicts their own conclusion.
23. The size of wind-tunnels grew within a few years from jets of 3 m to up to an 8 m jet diameter. The perfect example for the fundamental changes in research technology is a memorandum of the AVA of 7 May 1936: while wind-tunnels had previously been used to test relatively simple models, they had recently been a shift towards highly specific questions that could only be studied with very complex models (HA-DFVLR/FZ-AVA, correspondence 1933-9). Cf. in general Nicholas Rescher, *Wissenschaftlicher Fortschritt. Eine Studie über die Ökonomie der Forschung*, Berlin, 1982.
 24. Cf. Lothar Hirschfeld and Gerhard Kettenacker (eds.), *Der 'Führerstaat'. Mythos und Realität*, Stuttgart, 1981.
 25. A 'classic' by now, David Schoenbaum, *Die braune Revolution. Eine Sozialgeschichte des Dritten Reiches*, Cologne-Berlin, 1968, and Ralf Dahrendorf, *Gesellschaft und Demokratie in Deutschland*, Munich, 1965; cf. Martin Broszat, 'Grundzüge der gesellschaftlichen Verfassung des Dritten Reiches', in Martin Broszat and Horst Möller (eds.) *Das Dritte Reich. Herrschaftsstruktur und Geschichte*, Munich, 1983, pp. 38-63.
 26. MPI Archiv, Reich Aviation Ministry, streng vertraulich, Vorschläge für die Ausgestaltung der Luftfahrtforschung, 29 Apr. 1935.
 27. As for most of the politically important Reich authorities there is no modern study of the Reich Education Ministry that would have to deal with the interaction of bureaucracy and party and analyse their respective positions within the National-Socialist system; exemplary is Dieter Rebentisch and Karl Teepe (eds.) *Verwaltung contra Menschenführung im Staat Hitlers. Studien zum politisch-administrativen System*. Göttingen, 1986.
 28. MPI Archiv, records on research professorships, Baeumker to Bock, Blenk, Dieckmann, Georgii and Peters, 2 Feb. 1942. The instructive conflict on the pay schedule: BA, R 2/5421 (copy) Reich Aviation Ministry to Reich Ministry of Finance on 13 Oct. 1943, *ibid.* (copy), Education Ministry to Aviation Ministry on 4 Feb. 1944, *ibid.* (copy), memo for record by Fischbach on meeting of 25 Apr. 1944.
 29. MPI Archiv, Lilienthal Association II, Baeumker to Prandtl on 2 Nov. 1937; collection of presentations at the annual convention of the Lilienthal-Gesellschaft für Luftfahrtforschung in 1937, Berlin, 1938.
 30. *Ibid.*, Minutes on a meeting of 24 Apr. 1939, MPI Archiv, Deutsche Akademie für Luftfahrtforschung, 1937-42; W. F. Durand to Prandtl on 2 Dec. 1938; *ibid.*, Baeumker to Prandtl on 19 Mar. 1939. During the war there were strong complaints by researchers about their isolation from the international scientific community; cf., for example, HA-DFVLR/FZ-AVA, Betz to Ackeret on 13 Apr. 1940.
 31. MPI Archiv, Reich Ministry of Aviation, memo for record by Baeumker on a briefing of Goering, 4 Apr. 1936. For the history of the Academy cf. Fritz Hartmann and Rudolf Vierhaus (eds.), *Der Akademiegedanke im 17. und 18. Jahrhundert*, Bremen and Wolfenbüttel, 1977.
 32. MPI Archiv, Reich Ministry of Aviation, not catalogued, Baeumker to Prandtl on 7 Jul. 1936; cf. *ibid.*, Lilienthal-Gesellschaft I, Baeumker to Prandtl and Bosch on 6 Apr. 1936; BA, R 431/697, pp. 12-14, Deutsches Nachrichtenbüro, 2 Mar. 1938.

33. Baeumker, *Zur Geschichte*, p. 51. The development of the strictly basic research-oriented academy during the war merits separate analysis.
34. Stuttgarter NS-Kurier, No. 270, 13 Jun. 1936; HStA Stuttgart E 1308/3361, note of Biser to Köstlin on 31 Dec. 1936.
35. Cf. Leslie Simon, *German Research in the Second World War. An Analysis of the Conduct of Research*, New York, 1947, pp. 24–30.
36. Cf. Dieckmann, 'Münchener Institute', p. 413. On the organisation of the institutes and delineation of responsibilities: Flugfunk-Forschungsinstitut Oberpfaffenhofen [publ.], *Die Flugfunkforschung im Raume München 1908–1962*, Oberpfaffenhofen, 1963, p. 8; BA-MA, RL 39/1049, Dieckmann to staff of the FFO on 27 Aug. 1937, and Dieckmann to division chiefs on 25 Oct. 1937.
37. Particularly instructive: 'Deutsche Luftfahrtforschung im Zweiten Weltkrieg'. Report of a Canadian commission from 1945 (German Translation, 1983, HA-DFVLR).
38. HA-DFVLR, RLM 6/1, Planung der LFM, Stand Mai 1943; details *ibid.*, RLM 1–17.
39. Engine research – to say so already here – is representative of the problem of management of large-scale research ventures and of the failure of government-controlled research planning in the Third Reich. The development of jet and rocket engines decided on in 1938 failed because of 'egoism of contractors' and inadequate co-operation between researchers and developers. Neither the 'Arbeitsgemeinschaft für Triebwerksplanung' founded in November 1942 nor the special commissioner for jet propulsion systems appointed in September 1942 were able to eliminate competition between the services of the Wehrmacht and duplication of effort in industry and research, or to establish specific priorities; cf. HA-DFVLR, Akte Gemeinschaftssitzung, minutes of the meeting of the Arbeitsgemeinschaft für Triebwerksplanung on 4 Nov. 1942; BA-MA, RL 3/56, proposed organisation, dated 15 Dec. 1942; HA-DFVLR/FZ-AVA, correspondence Betz, Schmidt to Betz on 8 Sep. and reply of 15 Sep. 1943.
40. HA-DFVLR/FZ-AVA. RLM (copy), Reich Ministry of Aviation to AVA on 2 Sep. 1940; Reich Ministry of Aviation circular to the research centres, 19 Dec. 1940.
41. MPG Archiv, I. Abt. Rep. 1 A/1479 p. 74 (copy), Ministry of Aviation ordinance, 24 Jul. 1936.
42. HA-DFVLR/FZ-AVA, Reich Ministry of Aviation reports (copies), Reich Ministry of Aviation to director of AVA, 4 May 1937.
43. Bundesbericht Forschung 1984 (Deutscher Bundestag, 10. Wahlperiode, Drucksache 10/1543), p. 16; cf. Ingrid Deich, 'The Redistribution of Authority in National Laboratories in Western Germany', *Minerva*, 17, 1979, pp. 413–44.
44. Cf. Adolf Baeumker, *Ein Beitrag zur Geschichte der Führung der Deutschen Luftfahrttechnik im ersten halben Jahrhundert, 1900–1945*, Bad Godesberg, 1971, p. 63, who speaks of a 'balance between broad policy guidance at the top and its implementation by subordinate work units' (underscores taken from the original).
45. BA, R 2/12449, Wirtschaftspolitischer Dienst, 14 Jan. 1939.
46. Cf. Horst Boog, *Die deutsche Luftwaffenführung 1935–1945. Führungsprobleme*,

- Spitzengliederung, Generalstabsausbildung*, Stuttgart, 1982, pp. 72, 591-5.
47. MPI Archiv, Dt. Akademie für Luftfahrtforschung 1937-1942, Baeumker to Tank on 24 Dec. 1941; typical also is a summary of his attitude in a letter to Hippke on 6 Apr. 1944 (HA-DFVLR): 'I have always had a limited esteem for controlled science and admired the free growth of things in nature'.
 48. HA-DFVLR/FZ-AVA, Akte Historisch, memorandum for record by Engelbrecht, 11 Mar. 1938.
 49. Cf. Overy, Goering, p. 308; Boog, *Luftwaffenführung*, pp. 37, 237; Homze, *Armung*, p. 102.
 50. HA-DFVLR/FZ-AVA, official correspondence, Lorenz to Betz, 16 Nov., memo of Prandtl on telephone conversation with Baeumker of 16 Nov., and Lorenz to Betz on 27 Nov. 1940.
 51. HA-DFVLR, RLM 10/3, memorandum of Baeumker, 20 Oct. 1940, and BA-MA, RL 3/859, memorandum of Baeumker, 31 Dec. 1941.
 52. HA-DFVLR/FZ-AVA, priority research tasks (copy), Reich Ministry of Aviation to the research institute 27 Oct. 1941; organisational chart in Boog, *Luftwaffenführung*, p. 580.
 53. BA-MA, RL 3/859, Baeumker to Milch, 16 Dec. 1941; MPI Archive, Reich Ministry of Aviation, ditto, 10 Jan. 1942.
 54. Cf. Overy, Goering, p. 321.
 55. MPI Archiv, Geheimangelegenheiten, Madelung to Prandtl on 18 May 1942.
 56. MPI Archiv, uncatalogued, Georgii to Prandtl on 25 Jan. 1942; BA-MA, RL 1/20 p. 37, Prandtl to Milch on 26 Jan. 1942. On the 'self-mobilisation of science': Karl-Heinz Ludwig, *Technik und Ingenieure im Dritten Reich*, Düsseldorf, 1974, pp. 241-5.
 57. RGB. I (Reich Law Gazette), p. 425, 'Verordnung über die Errichtung einer Reichsstelle Forschungsführung des RLM und Ob.d.L.', 30 Jun. 1942; on the month-long deliberations: BA-MA, RL 1/20, pp. 8-39 (pp. 30-3, meeting of State Secretaries on 5 Jun. 1942); MPG Archiv, Forschungsführung, I-IV; cf. Ludwig, *Technik*, Düsseldorf, 1974, p. 327; Boog, *Luftwaffenführung*, p. 74; Overy, Goering, incorrectly naming Seewald as 'Chairman of the Research Committee'.
 58. BA-MA, RL 3/56, stenographic record of the meeting of 6 Jul. 1942; for the Reichsforschungsrat in 1937 and 1942 cf. Ludwig, *Technik*, pp. 216-38.
 59. Cf. the critique by Lorenz of co-ordination and delineation of responsibilities between research management and the Reichsforschungsrat (MPI Archiv, Geheimangelegenheiten, memorandum of Dec. 1942).
 60. Ibid., (copy) memo for record by Staatsrat Plendl of 28 Jul. 1942 concerning a meeting with Goering on 20 Jul. 1942; RL 1/20 p. 94, Goering's directive of 20 Nov. 1942.
 61. MPI Archiv, Forschungsführung I, Baeumker to Min.-Dir. Cejka (Reich Education Ministry) on 6 Oct. 1942; *ibid.*, Seewald to Prandtl on 19 Oct. 1942.
 62. MPI Archiv, Forschungsstellen, Baeumker to Prandtl, 21 Jul. 1943; cf. Ludolf Herbst, *Der Totale Krieg und die Ordnung der Wirtschaft. Die Kriegswirtschaft im Spannungsfeld von Politik, Ideologie und Propaganda, 1939-1945*, Stuttgart, 1982.
 63. MPI Archiv, correspondence with Baeumker, Baeumker to Prandtl, 20 Mar. 1945, and *ibid.*, Forschungsstellen, Prandtl to Osenberg on 27 Mar. 1945. Cf. Ludwig, *Technik*, pp. 262-71.
 64. MPI Archiv, Forschungsstellen, Baeumker to Prandtl, 21 Jul. 1943, *ibid.*,

- Geheimangelegenheiten, Georgii to Prandtl, 26 Jul. 1943.
65. MPI Archiv, correspondence with Baeumker (copies), Baeumker to Prandtl, 13 Sep. 1942.
66. Prandtl's remark to Baeumker in late 1944 rather characterises his sense of duty than his opinion on research management; he had always held 'that the four of us were called to this task by act of government and therefore cannot be held responsible for the fact that the choice of personalities was rather unfortunate' (MPI Archiv, Forschungsführung II, Prandtl to Baeumker, 19 Dec. 1944).
67. HA-DFVLR/FZ-AVA, priority of research projects, memorandum for record on a meeting of research management on 18/19 Aug. 1943; MPI Archiv, Geheimangelegenheiten, Georgii's circular of 18 Apr. 1944.
68. BA, R 26 II/7 Prandtl to Milch, 13 Jan. 1943 (quote); *ibid.* (copy), Rundschreiben des Geschäftsführenden Mitglieds der Forschungsführung, 11 Mar. 1943; MPI Archiv, Forschungsführung II, Baeumker to Prandtl, 8 Mar. 1943.
69. BA-MA, RL 39/349, Research Management Board to chairmen and commissioners, 20 Jul. 1943; *ibid.*, ditto, 28 Jul. 1943 (incl. excerpts of the activity reports).
70. BA, R 26/III pp. 13-15, minutes of a meeting of the Reichsforschungsrat on 5 Jul. 1943; HA-DFVLR/FZ-AVA, Fremde Forschungsanstalten, Wehrmacht Supreme Command to AVA, 9 Feb. 1944. On criticism: BA-MA, RL 3/1063, Schlichting to Research Management Board, 30 Apr. 1943.
71. MPI Archiv, Forschungsführung I, Georgii to Prandtl, 20 Nov. 1942; *ibid.*, Geheimangelegenheiten, Prandtl to Goering, 20 Nov. 1943; HA-DFVLR/FZ-AVA, Forschungsführung, handwritten manuscript of Betz, 3 Mar. 1944; for Osenberg campaign, cf. Ludwig, *Technik*, p. 251.
72. MPI Archiv, Geheimangelegenheiten, Madelung to Prandtl, 18 May 1942. Also symptomatic are the problems of the Riga field office of the AVA, where development work was conducted on de-icing of aeroplane skids and propeller-driven sleds (HA-DFVLR/FZ-AVA, official correspondence, Prandtl to Lucht, 30 Jun. 1942).
73. Cf. Overy, Göring, pp. 303, 337.
74. Walter Georgii, *Forschen und Fliegen. Ein Lebensbericht*, Tübingen, 1954, p. 304.
75. MPI Archiv, Korrespondenz mit Baeumker, Baeumker to Prandtl, 14 Mar. 1943.
76. MPI Archiv, Geheimangelegenheiten, memorandum for record, 8 Jul. 1943; BA-MA, RL 39/349, Circular of Research Management, 18 Jan. 1944; HA-DFVLR/FZ-AVA, Forschungsführung, Circular, 24 Oct. 1944; Georgii, *Forschen und Fliegen*, pp. 301, 308.
77. HA-DFVLR, Deutsche Luftfahrtforschung im Zweiten Weltkrieg. Report of a Canadian Commission of 1945, p. 6; Simon, *German Research*, *passim*.
78. Baeumker, *Ein Beitrag*, p. 64.
79. Information bulletin 'Luftfahrt', 23 Jan. 1943, cf. William McGucken, 'The Central Organization of Scientific and Technical Advice in the United Kingdom during the Second World War', *Minerva*, 17, 1979, pp. 33-69.
80. Alex Roland, *Model Research, The National Advisory Committee for Aeronautics, 1915-1958*, Vol. 1, Washington, DC, 1985, pp. 166-70, 178 (quote, p. 166);

- Manchester Guardian*, 13 Jul. 1942. Cf. George W. Gray, *Frontiers of Flight, The Story of NACA Research*, New York, 1948; *Fifty Years of Aeronautical Research, National Advisory Committee for Aeronautics (NACA) 1917-1958, National Aeronautics and Space Administration (NASA), 1958-1967*, not dated; Edwin P. Hartman, *Adventures in Research. A History of AMES Research Center 1940-1965*, Washington, DC, 1970; Frank W. Anderson, *Orders of Magnitude. A History of NACA and NASA, 1915-1980*, 2nd edn, Washington, DC, 1981.
81. Boog, *Luftwaffenführung*, pp. 68-76; Homze, *Arming*, pp. 209-16; Overy, *Air War*, pp. 191-6; Overy, *Göring*, pp. 326, 335-340; Tollmien, *Kaiser-Wilhelm-Institut*, pp. 477-80.
82. Mehrrens, *Das 'Dritte' Reich*, p. 61; similarly Armin Hermann, 'Naturwissenschaft und Technik im Dienste der Kriegswirtschaft', in Jörg Tröger (ed.), *Hochschule und Wissenschaft im Dritten Reich*, Frankfurt a. M.-New York, 1984, pp. 157-167, p. 163, who properly points out that under the auspices of the Reich Ministry of Aviation aeronautical research was essentially shielded against partisan intervention.

10

Commentary

Robin Higham

The chapters written by Messieurs Holley, Homze, Trischler and Facon all focus upon different aspects of readiness for war – or peace. It is possible to play roulette with the order in which their themes are tackled. But each must be seen against the complexities caused by the Technological Revolution in *matériel* and the immediately sequential rearmament expansion of the air forces and airlines and the industries upon which they depended. In neither the services and their ministries nor the industries were there the skilled managers or manpower to make the quantitative and qualitative leap into the unknown without friction.

As the authors point out, the various levels of leadership can be faulted for not paying attention to history, whether written and analytical or merely in the shape of their own experience of the First World War. At the same time, an international comparative view suggests that the failures which are often the subject of criticism or are laid to the charge of particular regimes because of their political colour need to be redescribed in terms of the universality of the difficulties faced.

Forecasting the future, just as much as refining a design to save weight, had been a hazardous occupation in aeronautics. Those who were too bold were apt to be dead or otherwise unemployed. Those who were too cautious produced unusable designs. It was those with fine judgement and political acumen, as well as sometimes great resources, who survived. Since the end of the First World War a winnowing process had been at work, so that by the time the Technological Revolution was in full swing in the mid-1930s the basic 'Ring', to use the British term, of firms had stabilised, though government would force more mergers on an industry that was far from efficient.¹

One last general introductory point is that while all the chap-

ters touched more or less upon international linkages, none pointed out how heavily interlinked the whole of aviation was in the inter-war years, with British radial engines and the international oil companies being very much central to the progress that was made, not to mention international competitions and the influence of the Guggenheims from America.² A number of omissions from the chapters will be commented upon at the end of my remarks.

One logical order in which to view the chapters is from scientific research through the development of what was possible to political decision-making to production. This means taking the Trischler chapter first, then the Holley, then the Facon and lastly the Hornze, which is what I propose to do.

Adolf Baeumker seems to me, with my orientation to the British scene, to have had a career much similar to that of Henry Tizard, who played a key role in the development of the research side of the RAF. Obviously every organisation needs someone at the top who understands its functions, needs and personnel, and who can fight its battles. And obviously Dr Trischler is correct that historians have paid too little attention to the arrival of 'Big Science' in the Technological Revolution. In part, this is because the history of science is not a very old field, and in part because historians of science have only recently begun to look at modern times. At the same time neither the history of aviation nor the history of management have been exactly flooded with eager explorers anxious to search out the real linkages in the economic, intellectual, or even metallurgical chains so essential to success in aviation.

Trischler also raises another interesting speculation in the mind of the reader. He has to credit the Nazis for reorganising aeronautical science because they were in power, just as Franklin Roosevelt was in 1940. But suppose some other government had come into office just as the Geneva disarmament conference had failed, especially over the intractable problems of aviation in 1934, would they not have gone the same way? In other words, was not the muddle and duplication in German aeronautical science crying out for rationalisation as costs rose? Certainly the British government of the day moved to consolidate the UK industry.³ And it was the British and the French who saved the American aircraft industry in 1938 and enabled FDR to ask for 50,000 planes in 1940.⁴ And in the Soviet Union it was the defeat in Spain that had repercussions there.⁵ Italy had begun to shoot her economic bolt by 1935,⁶ while France, as Patrick Facon

shows so well, simply could not get the four parties involved together to create a coherent programme. In Japan, as in Germany, apparently the short-war syndrome took control until too late.⁷ Perhaps above all what Trischler makes clear is that that in-fighting chaos within the German war machine, which was first revealed to us by General Walter Dornberger in his V-2,⁸ was the cancer which slowly destroyed aeronautical research in Germany, 1935-45, in spite of its links to the universities and its pay scales.

Professor Holley's chapter is fascinating in that it uncovers the weakness in thinking not only in terms of ancillary equipment, but also in the leadership of the Air Corps. Moreover, it emphasises the fact that airmen did not study history, a field they denied applied to them in the first place. Holley leaves us room to speculate as to the reasons for this. In the First World War the US Air Service was only in action a matter of months, and all its bombardment work was carried out in two-seaters.⁹ In these aircraft, the weight penalties of any sort of turret were too severe to be practicable. The US Air Service had little if any operational experience of Handley Page or Gotha-type machines with room in the tail for a gunner who could cover a large tail-cone area from that position, if the gunner could move his weapons in the slipstream. But more than this, perhaps, there was a streak in the American character which disliked the concept of defence, and which opted solely for offence. Thus bombers had their armament forward to break through enemy fighters to the target, while the proponent of defensive fighters, Claire Lee Chennault, had been pushed out of the Air Corps by the time his services as a gadfly could have been very useful to bomber designers.¹⁰ Ironically, from the standpoint of Holley's story, the US Army Air Corps developed the 0.5 calibre machine-gun without the turret it needed, while the British produced two turret designs, but stuck to the light 0.303 gun because they had plenty of ammunition. Yet their armaments people had 20 mm guns on hand ready to be tried when the Air Ministry agreed.¹¹ Even if the guns and turrets had been available, at present it is not clear that the air services had devoted the time and ammunition needed to teaching gunners to shoot.

Holley points, of course, to other basic problems which plagued all the air services – the deadly boredom of the inter-war years, the lack of liaison with tactical units, the failure to read technical literature, the reluctance to accept the dialectical method of problem-solving, and the refusal to re-evaluate doc-

trine, not to mention the constant shortage of money. Above all there was the failure of Air Corps Headquarters to realise the importance of armaments to the making of an effective air weapon, and to allocate resources accordingly.¹² To which we might add that this is all the more surprising considering that at least the following generations of Americans have been gadget-happy.

Having thus had Trischler place science in context and Holley do the same on a limited scale for technology, it is most useful to be able to turn to Patrick Facon's examination of the interplay between what was said at the Riom trials in 1942 as opposed to what the documents reveal about the process by which the French Higher Direction came to make air policy. Here Facon rightly notes that the French discussions, not unlike those of the British,¹³ reveal a great concern with numbers of aircraft in the front line, together with a better understanding of the matter of reserves. However, from the figures which Facon gives, it would seem that the French underestimated the attrition of aircrews in modern war.¹⁴ Perhaps more importantly, there appears to have been little discussion of the problems of mobile war, of the need for temporary airfields, and of a demand for ground transport for flexibility against a blitzkrieg.

But at least the French, much more than the RAF, seem to have believed that in a modern air war the decision would be quick, General Vuillemin estimating a fortnight before the Armée de l'Air collapsed. From a doctrinal position his problem was that the very nature of air warfare was changing with the new types of machines appearing. This seemed to necessitate a new doctrine. In retrospect it looks more as though the divisions were once again going back to those of 1918 – fighters, light-attack aircraft, medium and heavy bombers. Owing to the general turmoil in France, and over the nationalisation of the aircraft industry in particular, French aircraft design was about on a par with American – slightly behind that of the other major European powers. France was not allowed the time to sort out her problems until Riom, and then the various interested parties, naturally, sought to explain why the defeat of 1940 had occurred.¹⁵

What had happened by 1940 was that the complexities of aircraft procurement, air armaments, and grand strategy had, thanks to the Technological Revolution and the demands of rearmament, become far more complex and demanding than in the First World War. A process which in 1918 could still be

completed in six months from conception to operations was by 1940 taking from four to eight years, or from eight to sixteen times as long. Given the normal semi-annual change of French cabinets, the making of grand strategic procurement decisions cried out for the kind of reform that was introduced after 1945.

Knowing this, then, one would expect that Professor Homze's chapter would reveal a highly efficient German aircraft-production organisation. After all, here was a government headed by a leader who apparently knew his own mind, whose chief aviation lieutenant was a distinguished flyer, and whose air ministry was under the control of an experienced manager. Actually that is not quite the way that it worked out, of course. But what should be a most salutary lesson is the fact that the Allies, by having grounded Germany until 1922 and denied her military aircraft until after 1933, compelled German airmen to do exactly what the allies themselves should have been doing – studying the lessons of history. Applying the techniques developed by the Great General Staff from 1870 onwards, the nucleus of the air force examined what had happened in the First World War and came to sound conclusions about a tactical air force to support the Wehrmacht. It was this doctrinal stability which almost enabled them to win the Second World War in spite of the fact that they stabilised their aircraft designs too early in the war, failed to continue development, trained too few pilots when they had time, wasted their instructors, and did not go into full production until 1944.

At the same time it must be noted that much of the story that Homze tells of the inter-war years is paralleled in other countries. Firms fell by the wayside, the creation of Lufthansa followed that of Imperial Airways in 1924, aircraft production in 1933 was about the same as for the UK at the same period, and later the farming out of major factories to sub-units was paralleled in the UK by the shadow factory scheme,¹⁶ while a certain commonality existed thanks to international licences and peripatetic experts such as the later ULTRA chief F.W. Winterbotham¹⁷ and the engine designer, Sir Roy Fedden.¹⁸

These four chapters have been very positive in giving us views on the history of the inter-war period and, indeed, even insights into some of the larger problems which must be kept in mind when watching the build-up of the armed services for war or peace. I have especially added the last two words because there is a tendency to forget that those in the private sector who had had to borrow money and build factories for the vast new

expansion after the collapse of disarmament and the rise of rearmament were constantly worried that the boom would collapse and they would be left with expensive taxable properties on their hands for which they would have no use. And at least one school of military thought subscribes to the concept that the best way to win is to do so without fighting.

It has recently been suggested, or resuggested (I am not sure which!): if you want to change history, become a historian. As much as those in any other field, we in aviation history are in the position to make history by rewriting the past in a more refined and intelligent way. To do this in aeronautical history is going to require some new and deeper analysis of materials which have largely lain so far unexamined, at least by us. Let me just touch upon a few examples of what I mean.

In discussing the matter of front-line strength and reserves, little or no attention has so far been paid to the studies of wastage which were done in the early 1930s and to the planning documents¹⁹ which were issued to commanders-in-chief based upon those results. It is not clear from the RAF ones I have whether or not these were actually based upon First World War figures or not. And stemming from that, it is important to know what role, if any, salvage, repair and maintenance units were expected to play in the next war, because these would have a significant effect upon actual losses of aircraft and *matériel*.²⁰ But for them to be effective, recovery vehicles had to be provided and teams trained to proceed to wrecks and dismantle and bring them in. But would this be possible in a fluid battle? Front-line strength would also be affected by airfields, but that seems to be an almost totally neglected topic even within the confines of the Air Staff, at least in London.²¹ We know, on the other side, that the Luftwaffe did practice moves once or more a year, and that most aircraft before 1940 could still use grass fields. If aircraft were moving forward or rearward rapidly, were the squadrons adequately supplied with transport? And how was maintenance envisaged as taking place, and what would its relationship be to the strength of squadrons during a campaign? Did General Vuillemin expect his Armée would collapse essentially because it would be shot down, or because it would be grounded or immobile in a fortnight? And lastly, what was the conception of aircrew losses as opposed to actuality, and the reasons for the disparity, including medical and training causes? (By the way, we still need to know what documents were used routinely to record aviation activities so we can bypass the archives' doors,

and, equally importantly, realise what needs to be saved and explored.)

These four chapters have shown our continuing concern with the organisation and application of sciences and technology, with how doctrine and policy have been made, and with production. They are stimulating models, and far removed from the old nuts-and-bolts 'buffs' books on aircraft type after type. But I would conclude by suggesting that they are and should be signposts on the road to a multitude of materials still in obscure official histories, in the government and industrial archives, as well as in professional publications of the day, which will provide us with a yet better understanding of aviation history.

Notes

1. Currently the best description of an aircraft industry is Emmanuel Chadeau's *L'Industrie aeronautique en France: 1900-1950*, Paris, 1987. The American industry has not had the examination it deserves, though, for the post-1945 period there is Charles Bright's *The Jet makers*, Lawrence, Kans., 1978, and more recently the provocative study of *The World Aircraft Industries* by Daniel Todd and Jamie Simpson, Beckenham, Kent, UK, 1986.
2. These linkages are spelled out in Herschel Smith's *A History of Aircraft Piston Engines*, Manhattan, Kans., 1986, in F. R. Banks, *I Kept no Diary*, Shrewsbury, UK, 1978, and in Richard Hallion's *Legacy of Flight: The Guggenheim Contribution to American Aviation*, Seattle, 1977.
3. See the volumes in the Putnam series, for instance on Glosters, Hawkers, and others.
4. See H. Duncan Hall, *North American Supply*, London, 1955.
5. Robin Higham and Jacob W. Kipp, (ed.), *Soviet Aviation and Air Power*, Boulder, Co., 1977, Chapters 4, by Kenneth R. Whiting, and 11, by Otto Preston Chaney, Jr. and John T. Greenwood.
6. John J. T. Sweet, *Iron Arm: The Mechanization of Mussolini's Army, 1920-1940*, Westport, Conn., 1980, pp. 155-9.
7. The story of the Zero makes the Japanese situation clear. See René J. Francillon, *Japanese Aircraft of the Pacific War*, London, 1979 and Jiro Hori-koshi, *Eagles of Mitsubishi*, Seattle, 1981.
8. Walter Dornberger, *V-2*, London, 1954.
9. James J. Hudson, *Hostile Skies*, Syracuse, NY, 1968.
10. Martha Byrd, *Chennault*, Tuscaloosa, Ala., 1987.
11. H. F. King, *Armament of British Aircraft, 1909-1939*, London, 1971; G. E. Wallace, *The Guns of the Royal Air Force, 1939-1945*, London, 1972; Claude H. Keith, *I Hold my Aim*, London, 1946; P. Huskinson, *Vision Ahead*, London, 1949.

12. The history of training is a much neglected subject. Craven and Cate in Volume 6 of their history of the US Army Air Forces in the Second World War devote about 200 pages of about 4,900 to procurement and training of personnel for the USAAF. Released by the PRO in 1972 was one of the Air Historical Branch Histories, *Flying Training* (AIR 10/SSS1), a 1,000-page typescript of AP3233 on policy and planning.
13. Robin Higham, *Armed Forces in Peacetime: Britain 1918-1940*, Hamden, Conn., 1962, pp. 174-189, 201-7.
14. The RAF lost 1,000 aircrew in the Battle of France in 1940. A detailed discussion is in my chapter on the Battle of Britain in *Air Superiority*, USAF Office of Air Force History, Washington, DC, 1988.
15. See General Charles Christienne and Pierre Lissarague, *Histoire de L'aviation militaire Francaise*, Paris, 1980.
16. On the shadow factories and the like, see the official histories in the United Kingdom series on the Second World War (see Higham, *Official Histories*, Manhattan, Kans., 1970) and H. Montgomery Hyde, *British Air Policy between the Wars - 1918-1939*, London, 1976.
17. F. W. Winterbotham, *The Nazi Connection*, New York, 1978.
18. Bill Gunston, *By Jupiter! The Life of Sir Roy Fedden*, London, 1978 and The Centenary Journal of the Royal Aeronautical Society, London, 1966.
19. Dowding used S.D. 98 (PRO AIR 10/1595).
20. Air Ministry, *RAF, Second World War 1939-1945, Maintenance* (1954) was only released via the PRO in 1984.
21. As in note 20, *RAF in the Second World War 1939-1945, Works* (AP3236) (1956).

PART IV

Doctrine, Technology, Logistics

11

The Soviet Air Force: Doctrine, Organisation and Technology

Von Hardesty

The Russo-German War, 1941–5, or the Great Patriotic War as the Soviets call it, occupies a pivotal place in the Soviet experience. For the Soviet military, including the Soviet Air Force (Voyenno-vozdushnyye sily – VVS), this brutal four-year conflict marked the transition, or more properly the accelerated passage, to modernisation and power. The VVS in the summer of 1941 endured an unprecedented defeat at the hands of the Luftwaffe, only to struggle back from near-obliteration to become, in 1945, the largest tactical air force in the world.

The Soviet Air Force, then and now, cannot be understood apart from the Soviet military doctrine of combined-arms warfare. In the difficult days after Operation Barbarossa, the VVS evolved as a vital component in Soviet combined-arms warfare. This concept called for the interaction of air, ground, and, if required, naval forces. Much of the peculiar style of VVS in the Second World War – organisation, operations, aircraft design – mirrors this doctrine.

Such a doctrine had been anticipated in the pre-war years and served as a formalised, if not precise, mode of warfare. While the concept of combined-arms warfare defines the framework for VVS air operations, it does not explain the underlying factors that shaped the Soviet air triumph in the Second World War. The war itself, however, gave shape and character to Soviet military operations. The vast geographical area of the eastern front, combined with the extremes of climate, absorbed the major blows of the enemy. The Soviet military survived this moment of supreme peril. The VVS, as with all branches of the Soviet military, then faced the challenge of forging effective weapons and techniques to defeat and to expel a powerful and

resourceful enemy. The ultimate Soviet air victory rested on the capacity of the VVS to adapt to the requirements of modern warfare.

My paper suggests that the air army was the chief instrument used by the Soviets to contend with the enormity of the Russian landscape and, at the same time, to perfect the necessary skills to use modern technology. First organised in May 1942, the air armies became the primary means to concentrate Soviet air power in support of the ground forces. It is through the air armies in the last period of the war, 1943–5, that we can see the process by which the Soviets gained air supremacy in the east.

The Air Armies

The reorganisation of Soviet aviation into air armies, as part of the larger reforms of Air Commander A. A. Novikov, began in late spring, 1942 – those desperate weeks between the Battle of Moscow and Nazi Germany's second summer offensive. The air armies represented a major organisational innovation, and reflected the commitment of Air Commander Novikov and the Stavka to the centralisation of air power. Rather than disperse the now-depleted combat-aircraft inventory to the various armies or to the shattered matrix of military districts, which was the pre-war pattern, each newly organised air army was attached to an active front. The air armies provided a tool to achieve maximum leverage in a context of the war emergency and retreat. At the same time the air armies anticipated the longer-term goal of offensive operations by providing for mobility, flexible response, and concentration of air power. The usefulness of air armies became evident the following year, at Kursk, when the augmented Soviet air armies joined with infantry, mechanised units and artillery, to inaugurate a sequence of major Soviet counter-offensives against the enemy.

The air armies, which included both flying units and support organisations, soon became the largest operational units in the VVS. They were attached, alone or with additional air armies, to a front under the direct command of the air-army commander, his staff and a military council. The air army was subordinate to the Front commander, who simultaneously provided centralised control and co-ordination. As this command relationship evolved, the Stavka allowed a measure of autonomy to VVS

air-army commanders to encourage initiative and flexibility. By never permitting an army to be permanently attached to a front, the Soviets ensured that the VVS operated as a distinct, but subordinate, part of a combined arms team, a sort of flying artillery, as many have described it.

The Stavka created a total of eighteen air armies – seventeen from front-line aviation and one from long-range bomber aviation. The latter became the 18th Air Army in 1944, and reflected in its organisation and limited aircraft inventory the minuscule role assigned to strategic bombing by the Soviets during the war.¹ Three air armies (the 9th, 10th and 12th) were assigned to the Far East, and saw action only after the war against Nazi Germany had ended. A total of ten air armies saw sustained action against the enemy in the long and costly campaigns after Kursk. The rapid expansion of the relocated Soviet aircraft industry after 1942 allowed the average size of an air army to grow dramatically. Beginning with a modest aggregation of approximately 200 aircraft in 1942, air armies swelled to an average of 1,000 aircraft in 1943 and 1944. For the final Soviet offensives in 1945 some air armies possessed 2,000–2,500 aircraft. Over Berlin in the spring of 1945, for example, the 16th Air Army topped 3,000 aircraft.²

Before the VVS could mobilise and deploy air armies at optimum strength there were extraordinary problems to overcome. The grim legacy of Operation Barbarossa continued to haunt Soviet air recovery into 1943, a sort of conditioned sense of inferiority toward the Luftwaffe that expressed itself at the front. As the first victim of Operation Barbarossa, the VVS had lost enormous numbers of aircraft, mostly on the ground. These losses consisted largely of obsolescent pre-war types. Less apparent to the Luftwaffe was the survival of a large cadre of trained Soviet pilots; many would have another opportunity to fight. The invasion had been more disruptive in another way, interrupting the manufacture of later-model combat aircraft – Yak fighters, Il-2 *Shturmoviks*, and the versatile Pe-2 fighter-bombers. By 1943, these aircraft types began to appear in quantity; their arrival also coincided with the newly acquired confidence and aggressiveness of Soviet fighter and ground-attack units.³

The air armies faced a profound crisis in the area of communications. Novikov had forged ahead with the reorganisation of Soviet aviation at a time when the VVS possessed few radios, no effective network of ground facilities for command and control of air operations and a primitive aerial-reconnaissance

capability. Most air-to-air and ground-to-air communications were conducted by a primitive system of visual signals. Much of the hurried effort for modernisation would be devoted to this critical component, although progress would be painfully slow. The need for modern radio equipment and radar was apparent and urgent. The effective command and control of the air armies depended on a rapid modernisation in this critical area.

The defeats of 1941 had exposed another critical weakness in the VVS – the outdated and primitive combat tactics of all air units, especially fighter aviation. Novikov and his new air-army commanders quickly realised that pre-war tactical methods were inadequate against the highly skilled fighter units of the Luftwaffe. Aggressive fighter-pilots such as Alexander Pokryshkin had been extremely critical of their combat-readiness at the start of the war, and advocated a shift to 'vertical manoeuvre'. For Pokryshkin and other reformers, this meant the adoption of the basic German tactical organisation of the *Rotte* and *Schwarm*. In 1942 Soviet fighter aviation quickly shifted to the *para* or pair of two aircraft, one attacker and one defender, as the basic combat formation. Two pairs, one attacking and one defensive, made up a flight, with three or four pairs constituting a group. The willingness of Soviet air commanders to approve these reforms – in fact the dramatic abandonment of established training procedures – reflected the war-induced pragmatism that dominated the VVS throughout the critical years of the war. The air armies again become the conduit for these important changes. The willingness of air-army commanders such as K. A. Vershinin (4th Air Army) to support the ideas of Pokryshkin assured the ultimate recovery of fighter aviation.

Following the battle of Kursk, the Soviet air power assumed an ever-enlarging scope of combat activity: launching massed attacks during offensive operations, breaking into the enemy rear, and displaying increased skill in the complex task of mounting co-ordinated air strikes. By the end of the war the VVS had evolved as a mobile strike force, providing continuous air operations in co-ordination with the advancing Soviet ground forces.

Patterns of Mobilisation

The creation of the air armies in the spring of 1942 prompted a series of related organisational and mobilisation strategies that

were designed to equip the Soviet Air Force to conduct a War of attrition against the Luftwaffe. Four arenas of activity are worth mention and brief analysis: (1) the creation of the Air Corps of the Stavka Reserve; (2) the mass production of modern combat aircraft; (3) the systematic exploitation of foreign technology; and (4) the expanded use of advanced avionics and instrumentation.

At the time the air armies were organised in 1942, the eastern front extended down the interior of European Russia and the Ukraine for 2,400 miles. Later that year, as the German Army pushed toward Stalingrad and into the Caucasus, this front would extend to slightly over 3,000 miles.⁴ This enormous arena of combat placed heavy burdens on the extended supply services of both armies. For the Soviets, the initial phase was a defensive one, and the new air armies provided an effective vehicle for reinforcement, mobility and concentration of firepower. The Air Corps of the Stavka Reserve evolved as the chief means to husband the limited capacity for reinforcement. As the war progressed this component became even more crucial as the conduit to deploy the vast air armada the Soviet Union had mobilised to defeat Nazi Germany.

The history of the Air Corps of the Stavka Reserve is almost coextensive with the history of the air armies. Beginning in the autumn of 1942 and extending to the end of the war, the Stavka created 30 air corps and 27 air divisions. This burgeoning reservoir of air power, with new and re-equipped air units ready, paved the way for major offensive operations that commenced in 1943. The air corps were independent of the specific control of the air armies, and were linked administratively to the training directorate of the air force under General A. V. Nikitin. While Nikitin was subordinate to the Air Commander A. A. Novikov, the Stavka retained control of all reserve air units, deciding when and where they would be deployed to augment front-line aviation. Within the Air Corps of the Stavka Reserve newly trained airmen mixed with combat veterans who had been rotated to the rear, giving the air corps of the Stavka Reserve a deliberate blend of inexperienced and experienced personnel. Such a policy allowed for a smoother transition to combat for raw recruits and the much-needed rest and recovery of combat veterans. Both groups received advanced training with the latest model aircraft and equipment.

Reserve air corps operated in close proximity to active fronts. Combat veterans dominated the air corps command and staff

positions. New air units, drawn from the flight schools and technical schools, were trained and carefully merged with older groups. At critical junctures newly manufactured aircraft were flown directly from the factory to the reserve air units. Typically, a reserve air regiment trained for 60-90 days before being sent to the front, although circumstances varied with time, geography and the requirements for a given air operation. The training was intensive, keyed to the realities of air warfare, and fashioned to reinforce the emerging aggressive style of the air armies.

For support units working with resupply and logistics, there was considerable time devoted to practice - exercises in loading and equipment and supplies. A great deal of emphasis was placed on effective techniques and prompt response intervals for each category of supply.

Lectures, conferences, and elaborate training exercises dominated the life of reserve units. Modern techniques of air warfare, on the operational and tactical levels, were adapted to the training programme. Attention was given to both the theoretical and practical aspects of training. Following the lead of Novikov, reserve air units adapted to proven enemy tactics. For Soviet pilots there were frequent demonstration flights using both Soviet and German aeroplanes. By design the training regime exposed Soviet shortcomings and, in turn, these areas of weakness were clearly identified and altered. New tactics adapted from the enemy were carefully assimilated.⁵

Detailed Soviet accounts of the Air Corps of the Stavka Reserve are relatively few in number if compared with the historical literature available on the air armies proper and the various VVS air units. Soviet accounts portray the Air Corps of the Stavka Reserve as a shadowy and complex organisation, with its own brand of heroism. The work of reserve units was crucial to the war effort, and it was conducted in a context of urgency and herculean effort. The redeployment of personnel, aircraft and equipment was carried out by air or ground transportation, depending on circumstance. The forward echelon, the ground personnel of reserve units, departed by air, usually in C-47 transports or converted TB-3 bombers. They prepared new airfields which, more often than not, were grass strips with few, if any, amenities or hangars. They established communication and guided the various air units, who arrived as the second echelon. Squadrons moved out at intervals of 20-30 minutes. Frequently ground crews and other technical personnel crowded into fighter and ground-attack aircraft to ensure that

flying and technical personnel were not separated. Some experienced Il-2 pilots would frequently carry 2-4 people, and the pilots flying fighter aircraft could usually take one person apiece.⁶ The acquisition of modern air transports, in particular the Lend-Lease C-47s, greatly enhanced the redeployment capabilities of the Soviets.

In 1944-5, as the pace of Soviet offensives quickened, the Air Corps of the Stavka Reserve became a critical factor in combined-arms warfare against Nazi Germany. Each major offensive dictated elaborate plans and precise schedules for the reinforcement of frontal aviation and the stockpiling of supplies. The movement and co-ordination of reserve units with attached support entities placed enormous demands on air-force command structure. The effective administration of air reserves stands out as one of the major aspects of the Soviet Air Force's formula for victory.

Behind the the Air Corps of the Stavka Reserve was the Soviet aviation industry. The manufacture of modern combat aircraft occupied a central place in pre-war thinking. Once the war began, the overall Soviet strategy for victory dictated that the Soviet Air Force possess a quantitative edge over the enemy. Stalin himself took a personal interest in this aspect of war production, often intervening to decide specific issues related to design and quality control.⁷ The Soviet Union, to the surprise of the Anglo-American Allies and Nazi Germany, had managed to preserve the core of its aviation industry in the desperate days of 1941 through a programme of hurried evacuation of both plants and their workers to the rear. This arduous task, once completed, enabled the Soviets to meet the daunting requirements of the air war. The massive production of combat aircraft between 1942 and 1945 clearly demonstrated that the air victories of the Luftwaffe in Operation Barbarossa had been largely illusory. The greatest pre-emptive air campaign in history had destroyed thousands of aircraft, perhaps as many as 7,500, but Soviet air power endured. The survival of the Soviet aviation industry assured the capacity of the VVS to recover and fight a protracted war.

Anglo-American assessments of the Soviet aviation industry in the pre-war years were often fragmentary, lacking in detailed information, and not without bias. Most pre-war intelligence estimates concluded that the Soviet Air Force was the largest in the world, but few accurately assessed its latent strength. Western observers at the end of the decade of the 1930s viewed

Soviet aircraft designs as obsolescent, if numerous. This general attitude had been reinforced by Soviet combat reversals in Spain, the Far East and Finland. One intelligence report on Soviet aircraft production, filed by the US military attaché in Moscow on 4 April 1941, was typical, seeing in the development of the 'I-18' (MiG-3) a cumbersome new design, labour-intensive, produced in massive quantities, and inferior to Western models.⁸ Such an analysis was not without a degree of truth; but the larger process of re-equipping the Soviet air units with modern aircraft, the MiG-3 being a harbinger, was missed.

While the contours of Soviet war production, including research and development, are visible to us, much of the detail and nuance of this extraordinary structure is still hidden. Certain characteristics, however, are evident, and help to explain how the Soviets were able to organise, expand and refine their wartime production of aircraft. The Soviets placed an emphasis on simple designs, geared to mass production, and rigorous adherence to the standardisation of the basic fighter and ground-attack types. In addition, there was a distinct preference for quantity production of these proven designs. Modifications were not rejected in principle, only approached in a controlled fashion.

Stalin exerted a decisive influence on the evolution of the aviation industry. The Five Year Plans of the 1930s had laid the industrial base for the aviation sector. The exploits of Soviet airmen in the 1930s occupied a prominent place in the public life of the Soviet Union. Stalin placed a high priority on the development of a modern aviation industry, seeing in the aeroplane a convenient and powerful symbol of modernisation. In 1939, Stalin reorganised his aviation industry, setting up a separate Commissariat of the Aviation Industry (renamed the Ministry of Aviation in 1943), headed by M. M. Kaganovich. Later, in 1940, Kaganovich was replaced by A. I. Shakurin, who, with A. S. Yakovlev as his deputy, would preside over the aviation sector during the crucial war years.⁹

This reorganisation of aviation in 1939 and 1940, at the very end of the purge era, introduced a new dimension of competition into the aviation sector. New and younger designers appeared – Yakovlev, Lavochkin, Mikoyan and Gurevich, and Il'yushin – to compete in the development of a whole new generation of fighter and ground-attack aircraft. This critical shift to design and manufacture tactical aircraft was under way at the time of Operation Barbarossa, although the transition to

the new designs was roughly 20 per cent complete at the time of the German invasion. For the Soviets there was some compensation in the knowledge that the massive destruction of their aircraft by the Luftwaffe in the summer of 1941 had not compromised their capacity to develop and deploy a new generation of modern tactical aircraft superbly equipped to meet the challenge of the Eastern Front.¹⁰

The production of aircraft to meet the enormous demands of the war necessitated a high degree of co-ordination between the research institutes, the design bureaus and the factories. They were linked together in a common enterprise – to produce modern aircraft with ever-improving performance capabilities. Shortages in aluminium required a heavy dependence on wood and composite structures. Lend-Lease greatly assisted the Soviet aviation industry with shipments of machine tools, aluminium, steel and copper and other vital materials. While Lend-Lease enabled a more rapid shift to all-metal aircraft, the Soviets made the transition slowly, still making extensive use of wood components right up to the end of the war. The Yak series of fighter aircraft demonstrated the ingenuity and adaptability of the Soviets with wood and composites.

Stalin, according to Yakovlev, resisted the 'epidemic of improvements', insisting that aircraft improvements be incremental. There were penalties for 'groundless and frivolous changes'.¹¹ The gradual refinement of basic designs, from Yak-1 to Yak-3, La-5 to La-7, and Il-2 to Il-10 aircraft variants, mark the steady, but always controlled process of technological refinement. Standardisation was correctly understood as a necessary element to assure quantity production. The Soviet Union, by favourable circumstance, had begun the war with modern designs, possessing a whole new generation of fighters and ground-attack aircraft. The adherence to a few standard designs, always subject to incremental change or field modifications, allowed quantitative production without loss of commitment to quality.

The acquisition and adaptation of foreign technology became a vital dimension of Soviet wartime aircraft production. Air Commander Nõvikov, who at the outset encouraged the active emulation of German tactical organisation and techniques, carefully sought out the latest German aircraft for testing. The VVS created a special unit to conduct the analysis of enemy aircraft technology. Many captured enemy aircraft were analysed by pilots, technical specialists and engineers who, in turn, made

recommendations on how best to exploit the advanced technology that was obtained from Germany. Lend-Lease provided another, more predictable, conduit of modern technology, including not only a diverse range of modern aircraft but other valuable equipment associated with instrumentation, navigation and armament. For example, Lend-Lease made available 48 PBV-6A amphibians and 137 PBN-1 flying boats in 1944-5. These aircraft were equipped with modern radios, the latest navigational equipment and defensive armament. Included in this category of aircraft were over 100 Norden bomb-sights. Fifty of the aircraft were equipped with search radar. Some items were withheld (low-altitude bombing equipment, fire-control equipment, homing equipment and Loran), but the Soviets were generously supplied with spare engines and assorted parts.¹² Soviet aircraft-purchasing commissions, for example the one led by M. M. Gromov from Soviet transpolar, also visited the United States and sought out specific items and tested various aircraft specially fitted for Soviet use.¹³

If the United States generously supplied many fighter aircraft and medium bombers, the Soviets took a keen interest in heavy bombers. They applied pressure on the United States to supply through Lend-Lease the latest long-range bombers, in particular the B-17 and the B-29. The United States resisted these overtures, especially in the case of the B-29. The Soviets eventually acquired a handful of B-29s by less formal means. On 29 July 1944, a B-29 landed near Vladivostok after a mission over Manchuria. The Soviets obtained additional B-29s, perhaps those too by the same method, and launched the production of their own version of the B-29, the Tu-4. The copying of the B-29 was completed in the course of one year by the Tupolev design bureau, an impressive demonstration of the growing capabilities of the Soviet aviation industry at the conclusion of the war.

For air armies to function efficiently there was a need to perfect techniques for the command and control of front-line aviation. This became a critical combat imperative as early as 1942, largely for defensive operations, when the newly organised air armies were required to manoeuvre over vast areas and co-ordinate a variety of missions in close interaction with tanks and artillery. Increasingly, the VVS turned to air reconnaissance, radio, and radar to contend with the enlarged scope of operational and tactical missions.

To achieve these ends, Novikov oversaw the reform and expansion of the signal service in each air army. In May 1943,

one year after the formation of the first air army, the signal service had been reorganised, with new procedures and administration.¹⁴

In accordance with these changes, air armies developed two distinct radio nets, one for warning and the other for guidance. The first operated on a twenty-four-hour basis, providing VVS air army commanders with current information on the status of various operations. The second radio net was linked to command and control. Through this second radio net various air units were guided to their targets and then redeployed and/or withdrawn according to combat requirements. In the latter part of the war the radio communications of active air armies had been greatly expanded and upgraded. Other associated functions, for example meteorology, experienced similar improvement to meet combat requirements.

The transition by the air armies from visual to radio communications proceeded at a rapid pace, but not without difficulty. Most airmen had worked with a more primitive system. The VVS had entered the war with telegraph, telephone and messengers as the primary means of communication. Until 1943 few Soviet aircraft had been equipped with radios, and those few aircraft equipped with radios were usually flown by squadron leaders. Air-army commanders who fostered a rapid transition to radio encountered a considerable amount of inertia from the more veteran pilots who were unaccustomed to the new technology. For the new recruits the training programme incorporated radio communications as a standard part of the curriculum.¹⁵

The introduction of radio, largely supplied by Lend-Lease, necessitated an elaborate network of command posts at the front. The system that evolved aimed to ensure both centralisation and flexibility in the tactical zones. This matrix of command posts, linked to air-army commanders, allowed lateral contact and co-operation with the ground forces.¹⁶

The Soviets worked diligently during the war years to expand and upgrade their radar system. Much of this effort was directed to improve the efficiency of the air-defence units (PVO Strany), in particular to develop an effective early-warning system. The effort did not come easily, although some attention had been given to this area in the pre-war years. The Soviets had deployed the RUS-1 radar system in the Far East, a network that was later upgraded as 'RUS-2' and deployed around Moscow in May 1937. RUS-2 had the capacity, according to Soviet claims, to

detect an approaching aircraft at around 12.5 kilometres.

The REDUT system, a further development of RUS-2, had been deployed in various air-defence units in July 1940. The Soviets claimed that this system possessed a 115 km range of detection. The REDUT system entered mass production in 1941, and throughout the war it was employed widely by the Soviet armed forces. Pokryshkin, the famed Soviet ace, records that many airmen were sceptical of Soviet radar systems, feeling that they were ineffectual.¹⁷ The precise wartime capabilities of Soviet radar are suspect; but Soviet work in this technology would be valuable in the post-war years.

Having placed a premium on mobility and concentration of air power, the Soviet Air Force during the war gave considerable emphasis to upgrading the air-reconnaissance service. Again the reforms and technological refinements were keyed to the needs of the air armies. As the air armies assumed an aggressive offensive posture after 1943 the need for accurate aerial-reconnaissance data was apparent. This sense of urgency mirrored the larger requirements of the Soviet armed forces, committed to massive offensive operations to expel the enemy from Soviet territory.

At the outset of the war, the VVS lacked the requisite aircraft to conduct systematic aerial reconnaissance. Most aerial reconnaissance was visual, typically conducted at low levels in daylight hours, weather permitting. The range of the slow-flying R-5 reconnaissance aircraft was minimal, and it was always vulnerable to German fighters. The Soviets at this stage possessed only a modest capacity for aerial photography, although this tactic had been successfully employed as early as the First World War.

The Soviet Air Commander Novikov placed a high priority on this operational requirement as he fostered the rapid development of the air armies. The acquisition of fast modern reconnaissance aircraft, in particular the fast and durable Pe-2, permitted the Soviets to penetrate into the enemy rear areas with increasing boldness after 1943. By the final year of the war armies had expanded and perfected their use of air reconnaissance. Crucial to the success of this programme was the introduction of modern photographic equipment and the introduction of trained photo-interpretation personnel. At the high tide of Soviet offensives in 1944-5 air-photography units routinely flew missions over the entire depth of the German defences. Visual observation by low-flying Soviet aircraft remained critical, but was now

made far more effective by the widespread use of radio communications.

Patterns of Adaptation

The evolution of Soviet air power between 1941 and 1945 was characterised by improvisation and adaptation to the peculiar requirements of the eastern front. Fighting an air war in the vast and diverse arena of European Russia, the Ukraine and the Caucasus placed a great emphasis on rapid manoeuvre and the capacity to concentrate massed air power at crucial moments. Whether in defensive operations or air offensives, the VVS – a sort of flying artillery linked organically to the army – worked diligently to elaborate an operational style best suited to the rigours of the geography. The air army became the context in which to elaborate a number of special techniques. Already, the Soviets had demonstrated at Moscow their pre-war prowess at cold-weather flying, a capability that would allow the Soviets to maintain year-round flight operations. It would be another set of techniques, some brought to birth in the war years, that would establish a new level of combat-effectiveness. It is in this category of special operations that one can appreciate the range and complexity of Soviet operational art. Four examples stand out as unique and characteristic: (1) the air offensive; (2) the aerial blockade; (3) the use of camouflage; and (4) the air support of partisan warfare.

The concept of the air offensive, as elaborated in 1942, became the primary operational mode for the air armies. At the time the VVS had barely survived the first year of the war, and faced the still-lethal Luftwaffe in a second summer offensive by the German invaders. Perhaps the second blow would be the fatal blow. Yet Novikov's commitment to the new air armies anticipated another future, one that would see the VVS as a powerful striking force engaged in massed co-ordinated offensive operations against the enemy.

The air offensive, first used in the Battle of Stalingrad, called for the massive application of air power in the support of the Army in breakthrough operations. Air offensives were divided into two phases: air-preparation missions prior to the attack by the ground forces, and air-support missions in accompaniment to advancing troops and mechanised units. Both phases were highly complex in their execution, compelling the air staff to

work in close co-operation with the Front Commander. In the years 1944-5 the VVS deployed as much as 90-95 per cent of its front-line aviation in various air offensives. Breakthroughs and encirclements across the vast breadth of the Eastern Front placed a high premium on mobility, co-ordination, and, if required, powerful reinforcement. At major breakthrough operations at L'vov-Sandomir, Vistula-Oder and Berlin the VVS performed these tasks in an impressive manner.¹⁸

Linked to this doctrine of the 'Air Offensive' was the emerging Soviet understanding of 'air supremacy'. As opposed to Anglo-American operational practice, the VVS did not strive to exert a pervasive and overwhelming command of the air over the entire Eastern Front. In this unique context (as opposed to Western Europe) the VVS faced the dilemma of fighting in a vast geographical space with a finite number of air units (even air armies) relative to the task at hand. The VVS, always a tactical air force by choice, defined air supremacy within the framework of the Air Offensive doctrine, i.e. as the capacity to apply at will concentrated fire-power in close support of the ground forces. This concept of massed air power, applied more typically in the tactical breakthrough zones, gave the VVS a peculiar operational style. There was never a clear-cut, one-on-one air struggle in the East, a Battle of Britain or a Marianas 'Turkey-shoot', that provided a decisive moment or turning-point. Rather the VVS operated as a component of a larger juggernaut moving inexorably after 1943 across European Russia towards Berlin and ultimate victory.¹⁹

While operating within its context of combined arms warfare the VVS developed the aerial blockade as a tactical innovation. The Soviets devised the aerial blockade as a tool to assist the ground forces in encirclements of the enemy. Typically, Soviet aviation at the front and air-defence units co-operated in this manoeuvre, a concept that the Soviets claim went back to the early 1930s.²⁰

The Luftwaffe's successful, if costly, reinforcement of 100,000 encircled troops at Demyansk and Kholm in the winter of 1942-3 provided the VVS with its first opportunity to set up an aerial blockade. The Soviet effort was largely *ad hoc* in character, poorly executed and without great impact. For the Soviets, however, the Demyansk experience suggested the efficacy of the tactic. Later, at Stalingrad between 23 November 1942 and 2 February 1943, the VVS mobilised three air armies and PVO air-defence units (interceptor and anti-aircraft units) and at-

tempted an aerial blockade on a larger scale. The VVS appeared in force to challenge the Luftwaffe for local air superiority, intercepting German transports airlifting supplies to the encircled German forces and attacking, in co-ordination with the ground forces, enemy positions in the pocket at Stalingrad.

The VVS participated in other successful air blockades in the period after the epic victory at Stalingrad, although these complex adaptations of the aerial blockade would be less memorable. Aerial blockades in the Korsun'-Shevchenkovskiy, Belorussian, Königsberg, Budapest and Breslau operations allowed the VVS further opportunities to perfect its skills. A considerable amount of effort went into these operations, and, in each case, the Soviet air commanders faced a unique set of circumstances. Zones were set up, as in the classic case of Stalingrad, with a single warning system making full use of the newly acquired radar, radio and air-photography equipment. Centralised control of the participating air armies and PVO fighter-interceptor units was mandatory, with enormous demands placed on the logistical system. The Soviet aerial blockades, with their multizonal organisation, centralised control, geographical scope, and round-the-clock operations have no exact parallel in the West. Aerial blockades, as a technique, represent the maturing skills of the VVS in the war. As operations they have been studied only in an oblique fashion, and rarely as an expression of the Soviet Air Forces' impressive capacity for adaptation to the peculiar character of the eastern front.

The script for the rapid movement and concentration of air power prompted the Soviets to develop an elaborate technique for *maskirovka* or camouflage. No other air force expended such energy to conceal its movements. Building 'dummy' airfields became a massive undertaking for the Soviets after the first months of the war. Special teams within each air army worked systematically to confuse the enemy by constructing networks of bogus airfields. Wooden aircraft were built, along with a complex of revetments and dug-outs, to attract enemy attack. On the eve of air offensives, the VVS used concealment and camouflage to mask the movement of air units to the proximity of targeted breakthrough corridors. Simulated flights into dummy airfields were a typical ploy. The entire effort was massive, highly disciplined, and integrated into the larger organisation of the air armies.²¹

The Soviet Air Force elaborated a whole range of special techniques to assist the widely scattered and vulnerable partisan

units. Until late 1944 partisan activities were an active and vital dimension in the struggle against Nazi Germany. Operating from forests and swamps in the hinterland of Russia, these irregular forces depended heavily on the VVS to supply equipment, ammunition, and, if needed, evacuation to Soviet-controlled territory. The availability of modern signal equipment after 1943 greatly enhanced the ties of the partisan forces with the Soviet Air Force. It became apparent to the Soviets in the war that air power was an effective tool in irregular warfare. These operations were complex and demanding. They also represent another impressive area of improvisation and adaptation by the Soviets.

The air armies excelled as well in adapting their air combat tactics to fit the ever-shifting requirements of the war. At the start of the war, German airmen were surprised and alarmed at the tenacity of some Soviet fighter-pilots who, after expending their ammunition, on occasion would ram German aircraft. Typically, the Soviets chose German bombers as targets, and only rarely rammed, by accident or design, enemy fighters. The first air hero of the war for the Soviets was Victor Talalikhin, a young fighter-pilot who rammed a German He 111 over the night skies of Moscow in October 1941.²² Talalikhin's feat matched the ramming by Peter Nesterov, Russia's first air hero of the First World War. Such feats were not a form of suicide, as in the case of kamikaze pilots, but a legitimate air tactic employed by the Soviets, despite the context of desperation in which they were executed. After 1943, incidents of ramming sharply declined. This pattern reveals the defensive and extreme character of the tactic. In the offensive operations after Stalingrad, the tactic was no longer in general use, although Soviet pilots delighted in making head-on manoeuvres against German airmen, knowing of their apprehension about ramming.

Less apparent in the later period of the war was how the air armies experimented with newer, less dramatic, air tactics. Mobilising their best pilots, the VVS made extensive use of *okhotniki* or 'free hunters' – groups of two or four seasoned fighter-pilots who deployed to critical areas to attack targets of opportunity. First introduced at Stalingrad, they were employed aggressively in aerial blockades and in offensive operations. These pilots familiarised themselves with a particular sector and were given the latest-model Yak or Lavochkin fighter aircraft. The overall aggressiveness of the Soviet fighter units after 1943

expressed itself in the *okhotniki*, who embodied all the latest adaptations in fighter air-combat tactics, including vertical manoeuvre and the Luftwaffe's two and finger-four formations. Ground-attack aircraft, flying the Il-2 Shturmovik, also evolved special tactics to exploit fully the effectiveness of this Il'yushin design.

Adaptation involved as well the careful stewardship of material and human resources. Certain pre-war aircraft types, deemed obsolete in the minds of the Anglo-American air forces, found their usefulness in the East. Pe-2 biplanes were used systematically as night bombers. Often these air units consisted of women pilots. Older TB-3 bombers, slow and vulnerable to German fighters, found new usefulness as transports in support of the air armies. P-39 aircobras, considered obsolete and replaced by new models in the West, found a reprieve in the Soviet Air Force. Soviet pilots adapted the P-39 to a fighter-bomber role, and deployed it with some success. Anglo-American pilots were shocked to learn that the Soviets preferred the P-39 to the Spitfire or the P-40. For the VVS, war-induced pragmatism dictated that all aircraft, equipment and techniques should be mobilised for the war effort.

The history of the air armies provides an avenue to measure the quantitative and qualitative changes in the Soviet Air Force. The literature itself is largely heroic in tone, but not without value as history.²³ Deficiencies in air operations – even blunders – are acknowledged, but as asides in the triumphal march to victory. In addition, there was great continuity in the leadership of the air armies, with the major air armies having only one commander from 1943 to the end of the war.²⁴ They were typically younger men, talented and effective commanders. They translated the reforms of Novikov into the operational life of the air armies, ensuring centralised control, modernisation and skilful adaptation to the demands of the eastern front.

Certain air armies grew at a rapid pace during the period after 1943. One of the most active air armies, the 16th Air Army, is representative of the massive expansion of Soviet air power. Colonel General S. I. Rudenko (destined to be a post-war leader in the Soviet Air Force) first led the 16th Air Army into combat at Stalingrad in September 1942. At that time the entire inventory consisted of 152 aircraft. At the conclusion of the aerial blockade at Stalingrad the 16th Air Army had grown to nearly 600 aircraft, having been steadily reinforced by the Air Corps of the Stavka

Reserve. The subsequent campaigns show the dramatic pattern of augmentation: at Kursk 1,052 aircraft; at Belorussia, 2,319; at Vistula-Oder, 2,421; and at Berlin, 3,033.²⁵

The 17th Air Army, for example, faced the difficult change of moving across the Ukraine into Central Europe, from Stalingrad to Vienna. Unlike air armies operating in the North, the 17th Air Army had to adapt to mountainous terrain in the Balkans in pursuit of the retreating Germans through Romania, Yugoslavia and Hungary. Over such a vast terrain there were extraordinary problems with weather, primitive air-fields and logistical support. Frequently the 17th Air Army faced critical shortages of fuel. In late 1944 the widespread use of radio communication, aerial photography and radar suggests the advanced state of technological refinement achieved by a front-line air army. In 1945 the 17th Air Army differed markedly in organisation, size and equipment from what it had been on the Volga River three years before.²⁶

The 17th Air Army displayed a high degree of versatility in its operations. During the Yugoslav campaign in October 1944 the Air Army split into two groups (at the time it possessed an inventory of around 1,200 aircraft). This change was necessary to facilitate close support for ground forces pursuing the retreating enemy. There was constant movement, and the 17th Air Army experienced extremely low serviceability rates. Pilots were unfamiliar with the mountainous terrain, heavy fog and short, primitive airstrips. Despite these conditions, fighter and ground-attack units of the 17th Air Army maintained an effective and diverse level of operations, attacking enemy fortified positions, ground transportation and airfields. In contrast to the equipment of their earlier campaigns the fighter pilots of the 17th Air Army flew the latest Yak-3 and La-7 fighters.²⁷

Conclusion

The air armies provided the optimum organisational means to forge a mobile air force to contend effectively with the vast geography of the eastern front. After the initial German victories, the war for the Soviets became one of movement and encirclement. Air power played a logical, if not necessarily a decisive, role in the major offensives of the Soviet armed forces after 1943. The quantitative edge enjoyed by the Soviet Air Force was a crucial factor, but this factor should not conceal from view

the dramatic qualitative improvements achieved by the Soviets between 1942 and 1945. The war-induced organisational and technological changes were linked inextricably to the development of the air armies. The script called for more than the massive accumulation of aircraft. The mobility and effectiveness of the air armies required qualitative advances in equipment, technique and leadership.

The story of the air armies is also a saga of recovery from the disasters of Operation Barbarossa. With little experience in conducting large-scale offensive operations, the VVS, through the instrumentality of the air army, managed to elaborate an effective pattern for the incorporation of air power into combined-arms warfare. Without the immense productivity of the Soviet aviation industry – the manufacture of 125,000 aircraft during the war – the VVS could not have made its remarkable recovery. The fast and manoeuvrable Yak-3 fighters and the low-flying, seemingly indestructible Il-2 Shturmoviks epitomised the advances of Soviet air power in the Second World War. The ruthless pragmatism and skilful improvisation that shaped the development of these aircraft would not be fully apparent to outsiders, even the Soviet Union's wartime allies. By examining the evolution of the air armies we can begin to measure the highly accelerated process of modernisation that shaped the Soviet Air Force in its epic war against Nazi Germany.

There is a cruel paradox in this story: the building of the largest tactical air force precluded the allocation of critical resources to other areas of technology that would be crucial in the post-war years, in particular, to the development of heavy bombers and jet aircraft. The Soviet Air Force between 1941 and 1945 had turned on the twin axes of technological modernisation and adaptation. In the years after 1945, as Soviet air planners quickly discovered, there would be new challenges: the quest for parity with the United States in the development of jet aircraft and the strategic bomber.

Notes

1. The 18th Air Army, under the command of Marshal of Aviation A. Ye. Golovanov, saw action only at the very end of the war, and flew only 19,164 sorties (as compared with the 16th Air Army's 280,000 sorties, and the 2nd

- Air Army's 300,000 sorties). See Von Hardesty, *Red Phoenix: The Rise of Soviet Air Power 1941-1945* Washington, 1982, pp. 245-9.
2. See G. K. Prussakov (ed.), *16-ya vozdushnaya. Voenno-istoricheskii ocherk o boevom puti 16-i vozdushnoi armii 1942-1945*, Moscow, 1973.
 3. The Soviets manufactured over 125,000 aircraft and accepted over 14,000 from Lend-Lease.
 4. E. F. Ziemke, *Stalingrad to Berlin: the German Defeat in the East*, Office of Military History, United States Army, Washington, 1968, p. 500.
 5. See A. Pervov, 'Podgotovka i vospolnenie poter' aviatsionnykh Korpusov RVGK' 'Training Replacements and Filling Losses in the Air Corps of the Stavka Reserve', *Voenno-istoricheskii zhurnal*, No. 2, February 1980, pp. 10-15.
 6. See also A. Pervov's article in *Voenno-istoricheskii zhurnal*, No. 9, 1979, pp. 39-44.
 7. Serewyn Bialer in his anthology, *Stalin and His Generals*, New York, 1969, provides interesting coverage, through memoir literature, of Stalin's interference in aviation.
 8. Report No. 1897, 'Domestic Production of Aircraft: Latest Changes in Fighter (I-18) Production', I.G. No. 9505, submitted by the US Military Attaché, Moscow, 4 April 1941.
 9. A. S. Yakovlev, *Tsel' zhizni. Zapiski aviakonstruktora*, Moscow, 1972.
 10. J. P. Alexander, *Russian Aircraft Since 1940*, London, 1975, pp. 1-8.
 11. Yakovlev, *Tsel' zhizni*, p. 284.
 12. Air Intelligence Report No. 100-66/1-34, 'Concept of Russian Air Warfare', Office of Naval Intelligence, Navy Department, Washington, 1946, p. 3.
 13. Report on Soviet Mission led by M. M. Gromov. The Soviets eventually established a number of formal arrangements for technology transfer. The manufacture under licence of Wright engines and a Soviet version of the DC-3 (Li-2) are two important examples of Soviet exploitation of Western technology after the collapse of German-Soviet co-operation in 1933.
 14. I. V. Timokhovich, *Operativnoye iskusstvo Sovetskikh VVS v Velikoy Otechestvennoy voyne*, Moscow, 1976, p. 83.
 15. A. I. Pokryshkin records in his memoirs the reluctance of many Soviet airmen to accept the usefulness of radar.
 16. See N. Ostrumov, 'Mutual Identification and Target Designation of Troops and Aviation', *Voenno-istoricheskii zhurnal*, No. 8, August 1980, pp. 34-41.
 17. See G. G. Golubev, *V pary 'Sotym'*, Moscow, 1974, pp. 126-7; G. V. Zimin (ed.), *Razvitiye protivovozdushnoi oborony*, Moscow, 1976, pp. 43-59.
 18. Y. Veraksa, 'Air Offensive', *Soviet Military Review* (April 1973), pp. 38-41; Timokhovich, *Operativnoye iskusstvo*, pp. 101-94; K. A. Vershinin, *Chetvertaya vozdushnaya*, Moscow, 1975, pp. 214-15.
 19. See Von Hardesty (with John T. Greenwood), 'Soviet Air Forces in World War II', in Paul J. Murphy (ed.), *The Soviet Air Forces*, Jefferson, N.C., 1984, pp. 29-69.
 20. 'Vozdushnaya blokada', *Sovetskaya voennaya entsiklopediya*, Vol. 2, p. 279.
 21. Ye. Simakov, 'Operativnaya maskirovka VVS v nastupatel'nykh operatsiyakh', *Voenno-istoricheskii zhurnal*, No. 12, 1977, pp. 19-26.

22. See 'Proti vozdushnaya oborona Moskv 1941-1942', *Sovetskaya voyennaya entsiklopediya*, Vol. 6, p. 584.
23. K. A. Vershinin's *Chetvertaya vozdushnaya* ('The Fourth Air Army'), Moscow, 1975 is one example of this genre. Vershinin commanded one of the most active air armies in the Caucasus and Crimea sectors. His historical account is useful for insights into how air armies evolved with reference to tactics and technology.
24. The 4th Air Army; K. A. Vershinin, May 1943 to the end of the war; 13th Air Army; S. D. Rybal'chenko, January 1943 to the end of the war; 15th Air Army; N. F. Naumenko, May 1943 to the end of the war; 16th Air Army; S. I. Rudenko, October 1942 to the end of the war; 17th Air Army; V. A. Sudets, March 1943 to the end of the war.
25. Adapted from G. K. Prussakov (ed.), *16-ya vozdushnaya. Voyenno-istoricheskiy ocherk o boyevom puti 16-i vozdushnoy armii 1942-1945*, Moscow, 1973.
26. N. M. Skomorosov and others, *17-ya vozdushnaya v boy*, Moscow, 1977, p. 129.
27. *Ibid.*, pp. 208-34.

12

The Japanese Air Forces¹

Gerhard Krebs

Japan did not have a separate air force. Instead, her Army and Navy both had their own air arm.² Thus, both developed their own aircraft and their own training procedures. Relations between the two services were based not on co-operation but on rivalry, which at times turned to open hostility. They jealously denied each other access to their arsenals and combat doctrine.

The Army began to establish an air force, experimenting with balloons in the late nineteenth century. At the start of the First World War the Army and the Navy each possessed a small number of aircraft, which were purchased abroad and used primarily for training purposes. In the Siberian Intervention against the USSR from 1918 to 1922 the Japanese already had 31 aircraft.

Towards the end of the First World War, Japan began to develop her own aircraft industry with foreign licences from the US, England, France and later also from Germany.³ France also sent a large number of advisers. However, the Air Force was still being equipped with second-hand aircraft sold off by the victorious Western powers. They were only gradually replaced with aircraft manufactured in Japan, which were built mainly with American technology. In the war with China, which started in 1937, Japan employed a great number of aircraft and gained air superiority within a few months, but was unable to decide the war in her favour. The air force played a major role in the border conflict with the Soviet Union in the summer of 1939, but the Soviet Union soon gained air superiority.⁴

Since the end of the First World War the Japanese Navy had shown an interest in the construction of aircraft-carriers. The keel of its first one, the *Hosho*, was laid in 1919 at the government owned Yokosuka shipyard, and the vessel was commissioned in 1922. It was the world's first aircraft-carrier which was

built expressly for that purpose.⁵ Admiral Isoroku Yamamoto, who was to devise the attack on Pearl Harbor, showed a special interest in this new weapon.⁶ He also turned his attention to the development of torpedoes which could be launched from aircraft; the Japanese Navy had been experimenting with these since 1930. In the meantime industry was supplying excellent fighters, bombers and other aircraft. In 1940 the Navy was able to put the Zero fighter, which was to attain legendary fame, into service.⁷ For a long time the Western powers had not taken Japanese pilots and their planes seriously. Apart from successful dissimulation by the Japanese and pure wishful thinking the main reason was racial prejudice. The Japanese were said to be short-sighted and to suffer from night-blindness and disequilibrium – in short, they were extremely unsuitable as pilots. Their weapons and equipment, too, were regarded as third-class, and Japanese industry appeared to be trying to gain a share of the international market with poor copies of other countries' products, while just about satisfying the modest demands of their own country. Likewise, the Japanese were considered a failure in strategy and tactics because, when the war broke out in the Pacific, they had already been engaged in a war for four and a half years with China, which was technically far inferior, and had not scored any brilliant successes.

It was arrogance that made the Allies neglect intelligence and defensive measures, giving the Japanese the chance to reap successes in the initial stages of the war in the Pacific. In December 1941 they began hostilities with the attack on Pearl Harbor by 360 carrier-based aircraft, or one-quarter of their naval air force. They sank a number of American warships and destroyed many aircraft. During the invasion of the Philippines, Malaya and Singapore the Japanese air forces also played an important role. In December 1941 Navy planes sank two British warships, the battle-cruiser *Repulse* and the battleship *Prince of Wales*, off the Malayan coast.⁸ These seemingly impossible successes shocked the Allies; but over the years they managed to gain the upper hand owing to their greater resources. Only six months after Pearl Harbor, the US Navy sank four enemy aircraft-carriers in the Battle of Midway; in addition, the Japanese lost some 250 aircraft. This success, like many that were to follow later, was possible because the Americans had broken the Japanese crypto-code.⁹ In 1943, after deciphering enemy radio traffic, they managed to shoot down a plane carrying the Chief of the Imperial Fleet, Admiral Yamamoto.¹⁰

During the war in the Pacific, Japan manufactured some 60,000 aircraft, whereas the US turned out more than four times that number. On top of this, American planes were becoming increasingly sophisticated and their bombers were of ever-greater dimensions. In Japan priority was shifted from bombers to fighters, because they were resorting more and more to the defensive. Production quotas were changed accordingly. From October 1944 Japan resorted to suicide attacks against the American fleet, known as kamikaze (officially: *Tokubetsu kōgekitai*, or 'Tokko' for short= 'special attack unit'). In addition to the various types of aircraft, they also used a kind of manned bomb, filled with about one ton of highly effective explosive (Yokosuka MKY-7 Oka), which was specially designed for the purpose.

There are many reasons why Japan lost the air war.

1. The main reason can be assumed to have been the conviction that an early end to the war was possible if the initial successes demoralised the enemy and made him agree to a peace settlement on Japanese terms before the enemy's superior resources and industrial capacity could influence the outcome of the war. This wishful thinking seems to have been based on the experiences of the Russo-Japanese War of 1904-5.
2. The anticipated short duration of the war called for the capture of as many pawns as possible. Thus, the Japanese spread out their air forces, as well as their other forces, throughout the Pacific theatre of operations, and thus fragmented their effort.
3. The tremendous initial successes gave the Japanese a false sense of confidence, and they failed to develop or modernise their aircraft. They continued to lag behind the United States both in quality and quantity. When they finally began to shed their illusions in late 1942, it was too late.
4. There was no co-operation between the army and naval air forces.¹¹ Moreover, not only did the rivalry between the two services prevent concerted conduct of the war and the establishment of clear strategic priorities, but there was also persistent conflict over raw materials – especially oil – and production facilities.
5. Neither of the two air forces carried out long-range strategic attacks, apart from the one on Pearl Harbor. They merely provided tactical support for ground and naval operations. On the other hand, the unremitting American bombing

raids prevented the Japanese from stepping up their industrial production.

6. Japan's oil reserves dwindled rapidly. Most of the much-wanted shipments from the occupied Dutch East Indies fell prey to American submarines. Towards the end of the war, enemy surface vessels cut the line of supply. Both operations and training were curtailed by the oil shortage. And inexperienced pilots were easy prey in dogfights.
7. A shortage of raw materials and spare parts, the need for uninterrupted operations and the absence of qualified personnel in outlying areas meant that equipment that was subjected to excessive wear and tear was not being properly maintained.
8. Poor communications hampered support of land and sea operations and defence against American air raids. Night-fighting techniques were primitive, and radar was still in its infancy. Successful attempts to produce copies of radar equipment with German assistance came too late for it to be mass-produced.¹²
9. Large-scale air-supply missions were unknown. They were incompatible with the fighting spirit of the *samurai*, and thus the necessary resources had not been provided in time.
10. Although the kamikaze became a nightmare for the US Navy, they in fact created gaps in the Japanese air-defence system, as neither pilots nor aircraft could be replaced with the available resources.
11. Co-operation with their main allies, Germany and Italy, could not have been worse. Not only were the strategic objectives very different, but the lines of communication were broken down – except for a small number of risky trips by blockade-runners and transport submarines. Distrust and egoism inhibited the exchange of equipment and know-how. As a result, many measures came too late to be of any real use. The poor co-operation also made itself felt, for example, in the area of coal liquefaction, which was of great importance to the war effort.¹³ And delivery by Germany of the blueprints for the Me 262 jet plane came also too late.¹⁴
12. The single most decisive reason for the defeat of Japan appears to have been ineffective intelligence. Far too little was known about America's morale, her armed forces and her economic and industrial potential. The Japanese fatally underestimated the initiative, resourcefulness and fighting

spirit of their enemy. Japan regarded the US and her allies as profoundly non-military nations. Pacifism, isolationism and the low strength of the armed forces all seemed to prove this. The civilisation of the 'roaring twenties' seemed to prove the theory of 'degeneration'. Intelligence work was also hampered by the inability of the Japanese to break the enemy code.¹⁵

As a consequence, the Japanese over-estimated their capability to compensate for their shortage of soldiers, raw materials and industrial resources by their, as they saw it, unique Japanese fighting spirit. For them, Germany was the only other belligerent nation rated to possess equal military spirit, with the result that her chances of success were also over-estimated. Even at the time of the attack on Pearl Harbor, most of the Japanese were still convinced that Germany would defeat both England and Russia.

Notes

1. This study is largely based on the following two studies by Alvin D. Coox 'The Rise and Fall of the Imperial Japanese Air Forces', in Alfred F. Hurley and Robert C. Ehrhardt (eds), *Air Power and Warfare. Proceedings of the Eighth Military History Symposium, USAF Academy 1978*, Washington, 1979, pp. 84-97; and 'Flawed Perception and its Effect upon Operational Thinking: The Case of the Japanese Army, 1937-1941' (unpublished manuscript). This latter also includes references to more detailed literature. Any other sources used are listed below. In Japanese names the surname is given first.
2. For the organisation of the Japanese armed forces see the handbook *Nihon Kindaishiryokenkyukai hen* (Association for Research of Documents of Modern Japanese History, ed.), *Nihon rikukaigun no seido, soshiki, jinji* ('System, Organisation and Personnel of Japan's Army and Navy'), Tokyo, 1971.
3. For a more recent study on the co-operation of Japan and Germany in aeronautics after the First World War see John Chapman, 'Japan in German Aviation Policies of the Weimar Period', in Josef Kreiner (ed.), *Japan und die Mittelmächte im Ersten Weltkrieg und in den Zwanziger Jahren*, Bonn, 1986, pp. 155-73.
4. For details on this war along the Manchurian-Mongolian border see Alvin D. Coox, *Nomohan: Japan against Russia*, 1939, 2 vols, Stanford, 1985.
5. A good general account is given in Hansgeorg Jentschura, *Die japanischen Kriegsschiffe 1869-1945*, with contributions by Franz Mrva and Wolfram Müller-Yokota, Munich, 1970.

6. On Yamamoto see the biography by Agawa Hiroyuki, *The Reluctant Admiral. Yamamoto and the Imperial Navy*, Tokyo, 1980.
7. Cf. Horikoshi Jiro, *Eagles of Mitsubishi. The Story of the Zero Fighter*, Seattle, 1981. Useful information on Japanese fighters in the Second World War is also found in Jane's *All the World's Aircraft 1943/44*, London, 1944; William Green and John Fricker: *The Air Forces of the World. Their History, Development and Present Strength*, London, 1958; Kenneth Munson, *Die Weltkrieg-II-Flugzeuge. Alle Flugzeuge der kriegführenden Mächte*, 7th edn, Stuttgart, 1977. For further references see Coox, 'Rise and Fall'.
8. More recent studies include: Boeicho Boeikenshujo Senhishitsu (War History Division of the Japanese Defense Office), *Hi-to, Male homon kaigan shinkosakusen* ('Offensive naval operations against the Philippines and Malaya'), Tokyo, 1969; Arthur J. Marder, *Old Friends, New Enemies: The Royal Navy and the Imperial Japanese Navy. Strategic Illusions, 1936-1941*, Oxford, 1981.
9. On the Battle of Midway and the importance of the code-breakers see Boeicho Boeikenshujo Senhishitsu, *Middowe kaisen* ('The Battle of Midway'), Tokyo, 1972. Wilfried J. Holmes, *Double-Edged Secrets. U.S. Naval Intelligence Operations in the Pacific Ocean During World War II*, Annapolis, 1979; Ronald Lewin, *The American Magic*, New York, 1982; Gordon W. Prange, *Miracle at Midway*, New York, 1982; Edwin T. Layton et al., *And I was There. Pearl Harbor and Midway—Breaking the Secrets*, New York, 1985; Ronald H. Spector: *Eagle against the Sun. The American War with Japan*, New York, 1985; idem, *Listening to the Enemy. Key Documents on the Role of Communications Intelligence in the War with Japan*, Wilmington, 1988.
10. Details in Edward Van der Rhoer, *Deadly Magic*, New York, 1978.
11. Paul Wennecker, German Naval Attaché in Tokyo 1934-37 and 1940-5, recalled that on a tour of the Nakajima aircraft plant he was first guided by naval officers through their development and manufacturing division; then a door, which had been strictly kept closed, was opened, the naval officers bade him farewell, and on the other side Army officers received him for a tour. The Japanese naval officers had no access to this area (Wennecker in an interview with Gerhard Krebs on 28 July 1975 in Hamburg). Gerhard Matzky, German Military Attaché to Tokyo 1938-40, reported that although Japanese Army officers were never allowed aboard a warship, as a representative of the German Army he managed to get invited aboard an aircraft-carrier to observe manoeuvres. He had paved the way for this invitation by inviting a Luftwaffe officer to come as a courier from Berlin and then brief Japanese officers on the latest state of air armament. This obliged the Navy to return the courtesy (Matzky in an interview with Gerhard Krebs on 6 March 1976 in Bonn-Mehlem).

To ease the problems, Germany decided in 1939 to send a separate Air Attaché, Wolfgang von Gronau. He was responsible for co-operation with both the Army and the Navy Air Forces, with the result that neither trusted him, because he might pass secrets to their 'competitor', i.e. the other Japanese service (Wolfgang von Gronau, *Weltflieger. Erinnerungen 1926-1947* Stuttgart, 1955, p. 238). In late 1944, Luftwaffe General Ulrich Kessler was appointed Gronau's successor. He left Europe in the spring of 1945 aboard U 234, but the submarine put into an American port, when many surrendered and Kessler became a prisoner of war.

12. On the supply of 'Würzburg systems' and blueprints to Japan see the correspondence at Bundesarchiv, Militärarchiv, Genst. Gen. Qu. 6. Abteilung, Japan Bd. 1,2 (RL 2III/177, 178); Materiallieferungen Ausland allgemein (RL 2 III/645). See also the memoirs of Tsuda Kiyokazu, who was involved in the Japanese contribution to the project: *Maboroshi no reda – Urutsukurugu* ('The Dream of Radar – Würzburg'), Tokyo, 1981. Tsuda says that Germany had refused to supply it and agreed only after Japan had entered the war. In August 1942, the Japanese submarine I 30 left France with the drawings and a model of the Würzburg system. But in October it struck a mine in Singapore harbour and was sunk. The equipment was destroyed and the drawings rendered unusable by the salt water. In June 1943 a new model and drawings were shipped aboard two Italian submarines; an engineer (Heinrich Foders) of Telefunken Inc., the manufacturer of the Würzburg system, was also on board. Off the Moroccan coast, one of the submarines was sunk (Babari) and the drawings lost. Italy was about to surrender, and a German escort and supply submarine accompanying the second Italian submarine (Torelli), which was unarmed, threatened to sink her if she tried to put into an enemy port. On 30 August, however, the submarines reached Singapore. The German engineer had to reconstruct the radar equipment in Japan from memory, because new drawings did not arrive before January 1944.
13. On this, a recent work by Erich Pauer, 'Synthetic Oil and the Fuel Policy of Japan in the 1920s and 1930s', *Bonner Zeitschrift für Japanologie*, vol. 8, 1966, pp. 105–24; idem, 'Japans Energiepolitik und die Kohlebenszinindustrie im Zweiten Weltkrieg', in Klaus Antoni et al. (eds.), *Referate des VII. Deutschen Japanologentages in Hamburg* 11.–13. Juni 1987, Hamburg, 1988, pp. 229–41.
14. German construction experts were aboard U 234, which was to evacuate German technicians, drawings important to the war industry and even raw materials like uranium to Japan; however, it landed in an American port after the German surrender in May 1945 (see also note 11).
15. For an account of disparities in intelligence resources see Iwashima Hisao, *Johosen ni kanpai shita Nihon* ('Japan's total defeat in the intelligence war'), Tokyo, 1984.

13

The Influence of Pre-War Anglo-American Doctrine on the Air Campaigns of the Second World War

Williamson Murray

Two important books on military history, one dealing with a war at the beginning of this century, the other with a conflict over fifty years later, have recently appeared. Despite their relative distance in time – the first, on the British Army in the First World War, and the second, on the performance of the American Army in the Vietnam War – both works suggest an important paradigm that helps one understand the influence of inter-war doctrine on the conduct of air operations by the Royal Air Force and the US Army Air Forces in the Second World War. In an excellent study of the British Army, 1914–18 Timothy Travers argues that the British Army's generals brought a particular framework to the war, one heavily influenced by its colonial tasks, the peculiar aristocratic mental prejudices of the officer corps and the nature of professional military education.¹ It was not an army given to serious introspection. As Travers notes, 'with some degree of exaggeration, Edmonds [the official military historian of the army] argued that before the Boer War, "no one in the Army ever took the profession seriously". But, said Edmonds, "Things greatly improved after the Boer War, yet it was astonishing in how few years the elementary lessons of that war were forgotten in training. The army suffered above all, and always had done, from the system."² This peacetime mental framework made it extraordinarily difficult to adapt to the complex problems of tactical co-ordination of combined arms that confronted the British Army on the western front in the battles of 1914–18. It was not, as the inter-war critics claimed, that solutions to the war were obvious or its problems

easily open to solution. They were not.³ Nevertheless, Field Marshal Sir Douglas Haig and his staff were anything but far-sighted in addressing the tactical and operational problems that confronted them.⁴ A substantial blinker on adaptation to the constantly changing realities of front-line tactical conditions was constituted by the pre-war mental framework of those commanding at the highest level.⁵

Similarly Andrew Krepinevich argues in his book *The Army and Vietnam*:

To paraphrase General of the Army Omar Bradley, the United States can look back on Vietnam as the wrong war, at the wrong place, at the wrong time, with the wrong army. Simply stated, the United States Army was neither trained nor organized to fight effectively in an insurgency conflict environment The key to understanding this condition is a recognition that the Army's approach to war, referred to here as the Army concept, is the product of an organizational character that has evolved over time and that, because of high regard for tradition, has become deeply embedded in the service's psyche, or memory. The Army Concept of war, is, basically, the Army's perception of how wars ought to be waged⁶

Krepinevich goes on to underline how the army's concept and preparations for a mid-level to massive conventional conflict substantially and decisively prevented it from dealing with the very different conditions that it met in Vietnam. As a result, it fought a guerrilla war that demanded great political sensitivity as if it were fighting a Soviet invasion of Western Europe. The resulting massive application of fire-power proved anything but politically effective.

What are we to make of these two works? This paper will argue that this paradigm of a peacetime *Weltanschauung* substantially distorting the ability of military organisations to adapt to war is fundamental to understanding why they have generally proved inept throughout the twentieth century. This paradigm is, not surprisingly, useful in understanding the conduct of air operations by the RAF and the US Army Air Forces in Europe from 1939 to 1945. Not only did peacetime doctrine (one could almost say, dogmas) mislead wartime commanders at the start of the conflict, but it added to the costs and losses in the air offensive. Moreover, it diminished the contribution that Allied air forces were to make to victory in the Second World War. It is therefore worth examining the peculiar cultural *Weltanschauung*

that the Anglo-American air forces developed between the wars, and how these almost ideological views distorted air operations in the Second World War. Finally, it is worth noting that inter-war views on air power remained intact after 1945, and retain a substantial influence today (at least in the United States Air Force).

The crucial step that airmen took in the inter-war period was to reject the lessons of history.⁷ The British Air Staff explicitly stated in March 1924 what was to be a basic tenet of airmen through to present-day attitudes. In discussing what possible operational approach an air force might follow in attacking an enemy nation, it suggested that air units:

can either bomb military objectives in populated areas from the beginning of the war, with the objective of obtaining a decision by moral[e] effect which such attacks produce, and by the serious dislocation of the normal life of the country, or, alternatively, they can be used in the first instance to attack enemy aerodromes with a view to gaining some measure of air superiority and, when this has been gained, can be changed over to the direct attack upon the nation. The latter alternative is the method which the lessons of military history seem to recommend, but the Air Staff are convinced that the former is the correct one.⁸

Admittedly the world war had hardly been a complete test of the contributions that airpower might make in the future. Nevertheless, one is struck in studying the inter-war development of airpower by how little airmen looked back at the first appearance of the aircraft in war.

We might therefore ask what were the reasonable lessons that airmen might have learned from the First World War had they examined that conflict more openly and thoroughly. Airpower had appeared by 1918 in virtually every role in which it would appear in the conflict that began in 1939: 'strategic' and 'tactical' employment had both occurred. The Germans had bombed London; 'tactical' aircraft had carried out interdiction, reconnaissance for the army, and close air support for ground units both on the defensive and offensive. Finally, fighter aircraft had established fleeting control over their own and enemy airspace by strikes against enemy airfields and operations against enemy aircraft in air-to-air combat. In fact the crucial element in successful or unsuccessful air operations in the First World War had been the gaining of air superiority by fighter aircraft. Without

fighter support that could drive off enemy fighters, the interdiction, reconnaissance, and close air-support missions became suicidal. Yet of the inter-war air prophets, only Billy Mitchell argued that fighter support missions were essential to other air operations. In his first book Mitchell argued that the proper aircraft ratio for the US Air Corps should be 60 per cent fighter aircraft, 20 per cent bombardment, and 20 per cent reconnaissance. For Mitchell an air force's first task should be destruction of the enemy's air force, particularly his pursuit aircraft; not until one had achieved that goal could an air force turn against other targets. Thus, the enemy fighter force was the essential target.⁹

As evidenced by the above Air Staff memorandum, such was not the attitude within the RAF. For Sir Hugh Trenchard, commander of the RAF after the war, one could only gain and maintain air superiority through a 'resolute bombing offensive' against enemy cities and industries. Such an approach, he argued, would force the enemy to use his air strength in a defensive, not an offensive, role, thereby diverting his strength away from the primary task of 'strategic bombing'. For the conduct of an aerial offensive the Air Staff suggested 'that fighters would play almost no role, and as a result bombing squadrons should be as numerous as possible and fighters as few as popular opinion and the necessity for defending vital objectives will permit'.¹⁰ In 1923, in discussing a possible air war with the French, Trenchard underlined his belief that it would be a mistake to add four fighter squadrons to defend Great Britain; four bomber squadrons would be more useful. He argued to the Air Staff that shooting down a few French bombers 'would have little effect'. When one senior officer suggested that if the attacking French came over with 12 aircraft and lost 8, it would have a severe impact on their morale, Trenchard agreed, but maintained that such losses would have a greater effect on the morale of French pilots, because 'casualties affected the French more than they did the British'. Given that the world war had ended barely four years previously, this seemed a somewhat astonishing statement. Nevertheless, the essential point to Trenchard was the fact that 'the policy of hitting the French nation and making them squeal before we did was a vital one, more vital than anything else'.¹¹

Surprisingly, given his hallowed place in the hagiography of American air power, Mitchell's early ideas exercised little influence on the doctrinal development of American air power in the

late 1920s and 1930s. By 1926 training manuals in the Air Corps Tactical School were arguing that attacks on enemy air factories might 'have a direct, although not . . . immediate effect on the enemy air force'.¹² Within a few years, American airmen had taken the leap to a belief that attacks on industrial targets, precision in nature, could cause the collapse of the enemy's whole economy. Along with this went the disappearance of the belief that fighter support was necessary both to protect bomber formations and to attack the enemy air forces in an aerial offensive. As one instructor at the Air Corps Tactical School put it in the early 1930s: 'A well-planned and well-conducted bombardment, once launched, cannot be stopped.'¹³ By 1935 bombardment supporters were arguing that even if enemy pursuit planes possessed 'overwhelming superiority in all factors influencing air combat, . . . escorting fighters will neither be provided nor requested unless experience proves that bombardment is unable to penetrate such resistance alone'.¹⁴

The impact of such assumptions about air power would have a direct impact on the conduct of bomber operations in the Second World War. As the British historian Anthony Verrier has pointed out: 'The short point is this. When the Bomber Command missing rate started getting into double figures then its chiefs got interested in the scientific war of wits, but not before.'¹⁵

Only after the second Schweinfurt raid did Ira Eaker push drop-tanks for fighter escorts and long-range fighters to the top of his priority list. The first, time fixed; the solution to the second, the long-range pursuit fighter, largely resulted from accident, certainly not from an organisational drive to push technology.¹⁶ Harris would desperately note in late winter 1944, after Bomber Command's defeat in the Battle of Berlin, that his forces needed 'the provision of night-fighter support on a substantial basis'.¹⁷ If one should not be surprised that in the early war air commanders were unprepared to meet enemy air defences, it is astonishing that not until 1943 did the conditions of the air battle finally force a substantial reassessment. The only explanation is that pre-war assumptions remained so strong that the real conditions of aerial warfare made relatively little impression. D. C. T. Bennett, the ruthless commander of Bomber Command's pathfinder force, and one of the few RAF group commanders to fly on active air operations in the Second World War, argued in a post-war oral interview that he believed all senior air commanders should fly on active operations in war,

and that for every one killed, one would save the lives of 200 aircrew.¹⁸

Not surprisingly, Anglo-American air forces proved generally resistant to developing long-range escort fighters. With the vulnerability of the 1940 British bombers, it was clear in December 1939 with the fiasco over the Heligoland Bight that they could not survive in daytime unescorted by fighters. There were possible solutions: for the short term, one could extend existing fighter range by use of drop-tanks; in the long run, one could develop long-range escort fighters. The RAF, however, displayed little interest in drop-tanks, and dismissed the notion that British industry could develop a long-range fighter capable of taking on German fighters. Despite proddings from Sir Hugh Dowding, head of Fighter Command, that the RAF needed a long-range fighter, Air Vice Marshal W. S. Douglas, Assistant Chief of Air Staff, argued in March 1940 that:

It must, generally speaking, be regarded as axiomatic that the long-range fighter must be inferior in performance to the short-range fighter The question had been considered many times, and the discussion had always tended to go in circles The conclusion had been reached that the escort fighter was really a myth. A fighter performing escort functions would, in reality, have to be a high performance and heavily armed bomber.¹⁹

One might note that it is also axiomatic that one will not invent what one excludes from possibility. In June 1941 Sir Charles Portal, Chief of Air Staff, informed Churchill that a long-range fighter could not hold its own against a short-range fighter; thus the former could never fly where they might expect opposition from the latter. Churchill's response was that such a view closed 'many doors'.²⁰ The ill-fated low-level daytime Lancaster raid against the MAN works in Augsburg underlined Churchill's conclusions.²¹

Not surprisingly the American case ran along similar lines. Even those on the fighter side at the Air Corps Tactical School, like Claire Chennault, displayed little interest in using fighters to escort bombers.²² Such lassitude and inertia existed within the development command's drop-tank engineering programmes in the 1941-3 period that VIII Fighter Command in Britain, and V Fighter Command, *operating in New Guinea*, designed and produced rough and workable drop-tanks before the engineers at Wright Patterson.²³ It is worth noting that by the early 1940s the

US Navy had developed carrier fighter aircraft whose range was considerably in excess of that of the pursuit aircraft then entering the US Army Air Forces.²⁴ Then, as now, there was a reluctance on the part of one service to buy the aircraft designed by a sister service (for the same bureaucratic reasons). One sees a general opposition to the idea of long-range fighters to contest the air over enemy territory. As a result, the British almost immediately moved to the night area-bombing offensive; the cost to the Eighth Air Force of such attitudes would prove extraordinarily high in summer and autumn 1943, and come close to bringing the daylight 'strategic' bombing effort to collapse.

Definitions in military organisations are essential to their understanding of the world. Classical military terminology has divided the framework within which both military historians and organisations examine conflict into three (and in the German case four) constituent parts: the political, the strategic (for the Germans, and increasingly in American terminology), the operational, and the tactical levels of war. The Anglo-American air forces, reflecting their generally ahistorical framework, however, redefined that classic framework in such a fashion as to influence not only their adaptation to the conditions of war in the Second World War but also their willingness to co-operate with the other services. By the 1930s Anglo-American air advocates had defined attacks on the enemy homeland, whether against his population or his industrial base, as 'strategic' bombing. They defined all other types of aerial missions as 'tactical'; air interdiction, air defence, reconnaissance, close air support, air superiority, all of these missions by definition represented 'tactical' air power. The consequences were serious. As a result, British and Americans worked within a different framework through which to organise the world.

We might usefully explore the definitional problem further, because its consequences for the conduct of air operations in the Second World War are important. The problem confronting the Germans in 1940 elucidates the misuse and misunderstanding that result from the use of 'strategic' and 'tactical' bombing both during and after the war (they are still current today). The German strategic problem in the spring of 1940 can be stated clearly: defeat the Allied armies in the field in Western Europe or lose the war.²⁵ To help solve that problem, the Germans had a number of operational choices as to how they could employ the Luftwaffe: air superiority, support for the army, or attacks on the enemy's factories and/or centres of population.²⁶ Given

the strategic situation, the German emphasis on the first two areas made eminent operational and strategic sense within a classic military framework. The problem, of course, comes when one uses the airpower theorists' definitions, because then one has to refer to a 'tactical' use of air power by the Germans in the 1940 campaign when in fact it was a strategic choice.

This issue of definitions is an important one. Not only did it interfere with the integration of the Anglo-American air effort into the larger strategic framework, but it has also muddled the water for historians since the war.²⁷ The result of the first factor created an atmosphere within the RAF and the Army Air Corps that came close to an ideological view of airpower and its proper employment. Admittedly, part of this *Weltanschauung* resulted from a desire of the RAF to maintain its independence and from a desire to gain independence on the part of the US Army Air Corps. But when all is said and done, the definitions of 'strategic' versus 'tactical' air power set an order of priorities within those air forces. Ironically, the Chamberlain government, in one of its few far-sighted moves in the late 1930s, forced an unwilling RAF to invest in the air-defence system that eventually won the Battle of Britain.²⁸ Even here a mechanistic, ahistorical view of airpower nearly provided Fighter Command with the wrong weapon. As late as 1938 the Air Staff was arguing that the Spitfire and the Hurricane did not represent a satisfactory solution to Britain's air-defence problems:

The speed of modern bombers is so great that it is only worthwhile to attack them under conditions which allow no relative motion between the fighter and its target. The fixed-gun fighter with guns firing ahead can only realize these conditions by attacking the bomber from dead astern. The duties of a fighter engaged in 'air superiority' fighting . . . require an armament that can be used defensively as well as offensively in order to enable it to penetrate into enemy territory and withdraw at will. The fixed-gun fighter cannot do this.²⁹

Luckily for the British, Fighter Command's leader, Dowding, put up a spirited defence against buying the two-seater Defiant instead of Spitfires and Hurricanes.³⁰

The priorities established by definition, of course, extended to co-operation with the other services. The army was the most obvious case in point. Close air support and interdiction of ground forces remained at the bottom of RAF priorities. In

November 1939 an Air Staff memorandum noted, at a moment when considerable evidence was already there to suggest what the Germans had done in Poland, that:

Briefly the Air Staff View, which is based on a close study of the subject over many years, is as follows: The two functions of bomber aircraft in support of the army are to isolate the battlefield from reinforcement and supply, to block or delay the movement of reserves, and generally to create disorganization and confusion behind the enemy front But neither in attack nor defence should bombers be used on the battlefield itself.³¹

The larger point here is not that the RAF preferred the interdiction mission to the close air-support mission; it is that both missions figured well down on its list of priorities. On 10 May 1940 the German offensive on the Western Front released Bomber Command from the inhibitions that prevented it from attacking even warships in port. It immediately concentrated its efforts on finding and attacking targets in German cities rather than on contributing to the great land battle on which Britain's continental interests depended. One can argue that Bomber Command could not have intervened successfully in that battle, just as it had virtually no impact on the German home front in the first year of the war. But surely one is dealing with both pre-war influences as well as current doctrine: the RAF was simply not interested in using Bomber Command against the German army.

It might be useful to contrast Anglo-American air doctrine in the inter-war period with the doctrine developed by the Germans, in order to emphasise some of the weaknesses in the Allied approach. The Luftwaffe's basic doctrine of employment, *Die Luftkriegführung* ('Conduct of the Air War') still today reads well.³² Contrary to post-war historiography, the Luftwaffe showed interest in what the Anglo-Americans termed 'strategic' bombing. But early on, due to experiences in Spain and to Germany's geographic position, Luftwaffe doctrine placed such attacks within the larger context of co-operation with the army to achieve national goals. The Germans expressed doubts as to whether 'strategic' bombing offered a quick and easy solution to the problems of modern warfare. As *Die Luftkriegführung* pointed out, 'the nature of the enemy, the time of year, the structure of his land, the character of his people, as well as one's own military capabilities' should all play a determinant role in

how an air force should be used.³³ Air war against an enemy's industrial base should occur only when one could affect quickly the war's outcome, second when land and naval operations had prepared the way, third when there was a stalemate, or fourth when a decisive result could be achieved only through the destruction of the enemy's economic sources of power.

The Germans did have considerable experience in Spain to suggest that some of the basic assumptions of air-power theories were off target. But more important was the fact that, unlike British and American air strategists, the Germans faced the prospect of a large-scale land battle from the moment that a war began; they were never in a position to ignore the demands of Germany's ground forces. The Luftwaffe could dream of attacking Prague, or Warsaw, or Paris or the industrial infrastructure of enemy states, but no matter how successful such bombardments might be, the gains might not recompense the Reich for losses in the ground campaign and frontier provinces like Silesia or the Rhineland. While the Luftwaffe was still working out the tactical and operational problems of army co-operation in a mobile environment,³⁴ it was clearly the only air force capable of effectively supporting the ground battle; moreover, it would make a substantial contribution to victory over France, and play a crucial role in the defeat of British ground power and the elimination of the Western Front from 1940 until 1944.

In most respects the Anglo-American Combined Bomber Offensive reflected the beliefs and assumptions of a comprehensive doctrine developed before the war. For the British, area bombing fitted naturally with a doctrine that emphasised the impact of air power on civilian morale and the home front. As early as October 1918, a study within the Air Ministry had suggested that 'In the period from August to October [1918], evidence has accumulated as to the immense moral[e] effect of our air raids into Germany.' Therefore, 'though material damage is as yet slight when compared with moral[e] effect, it is certain that the destruction of "morale" will start before the destruction of factories and, consequently, loss of production will precede material damage'.³⁵ Throughout the 1920s and 1930s the RAF considered the enemy working class the weakest link within an opposing state, one that would remain vulnerable to the impact of a campaign that aimed not just to 'dehouse' but to kill.³⁶

Admittedly, other factors pushed Bomber Command towards the area campaign: weaknesses in navigation, the inability of

bomber formations to protect themselves in daylight, difficulties in bombing targets accurately at night, etc. But doctrine had already established the proclivities before the war, and it would push RAF leaders, particularly those within Harris's realm, into a single-minded effort to bludgeon Germany into surrender. The question here is not whether or not the area-bombing campaign contributed to the defeat of Germany; there is little doubt that it made a substantial contribution.³⁷ Rather, the question is whether by a single-minded drive to accomplish the 'strategic' bombing offensive the British missed substantial chances to use their four-engine bombers in operations other than area attacks against the German population.

In winter 1940, while watching German bombs fall on London, Harris and Portal suggested to each other that while the British population had displayed a stiff upper lip, the Germans were not made of such stern stuff. Not surprisingly, both men exhibited strong aversion to other uses of air power, whether it be as support for the Battle of the Atlantic, in campaigns in the Mediterranean, or even as support for the American precision-bombing campaign against the German industrial web. The area-bombing effort received support from the wings, where Lord Trenchard sounded the call for a 'proper use of airpower'. In a paper submitted to the Cabinet in 1941, the former chief of Air Staff argued for the bombing of Germany's civilian population over any other possible use:

If you are bombing a target at sea, then 99 percent of your bombs are wasted, but not only 99 percent of the bombs are wasted but 99 percent, too, of the pilots and of the training which went to produce them . . . If, however, our bombs are dropped in Germany then 99 percent which will miss the military targets all help to kill, damage, frighten, or interfere with Germans in Germany, and the whole 100 percent of the bomber organization is doing useful work and not merely 1 percent of it.³⁸

One year later, despite the fact that the German U-boat campaign in the Atlantic was threatening to destroy Britain's economy, Harris, now leader of Bomber Command, railed to Churchill about the diversion of aircraft production from his command to support the hard-pressed navy in the Atlantic:

The strength of Coastal Command, which is composed largely of suitable bomber types, is today almost the equal of Bomber Command.

It achieves nothing essential, either to our survival or to the defeat of the enemy. It abates little, not even the possessiveness of the Admiralty. It aids by preventing a few shipping losses— a very few. Those few losses we can bear awhile if we do not further embarrass our shipping position by adding to our difficulties the transportation and support of vast armies overseas . . . Coastal Command is therefore merely an obstacle to victory. By redirecting Coastal Command to the offensive, it could, in conjunction with Bomber Command, do . . . more harm to the enemy . . . situation as a whole than it can do or has done in years of waste and misemployment in its present wrong and mainly futile occupation.³⁹

The unwillingness to consider even small diversions from the 'strategic' bombing effort came close to costing the Allies the Battle of the Atlantic. At least in the American case the need for long-range air support for the convoys came earlier; the arguments instead revolved around the centralised or decentralised control of air assets supporting the anti-submarine war. These arguments finally reached the point where the army chief of staff, General George Marshall, finally broke up the Army Air Force command supporting the navy off the American coast and turned the assets over to the Navy.⁴⁰ Thus, the mission of protecting American coastal waters fell entirely to the US Navy, where it has remained to this day. This paper does not argue that the Battle of the Atlantic should have received priority over the Combined Bomber Offensive; but surely the need for long-range patrol aircraft should have received a high priority. And the diversion of some long-range air resources to the Battle of the Atlantic might have swung that crucial balance earlier than May 1943.

In August 1942 American daylight bombers began operations from bases located in Britain. Despite British efforts to dissuade the Americans from launching precision-bombing attacks in daylight, the Americans persisted. By October 1942 General Ira Eaker had informed General Carl Spaatz that accumulated experience indicated that B-17s 'could cope with the German day fighter'. One month later, on the evidence of the first 1,100 missions flown, Eaker argued that Luftwaffe fighters were no match for the closely-flown American bomber formations, since the loss-rate had been a minuscule 1.6 per cent. A closer look at the figures should have suggested a more ambiguous picture. Missions that had received escort support from RAF Fighter Command had suffered well under 1.0 per cent loss. Those,

however, that had flown into occupied France beyond the range of British fighters had suffered a more serious loss rate of 6.4 per cent. And none of the American bomber formations had yet tested the Reich's air defences.⁴¹

Diversion of American air units to support the landings in North Africa delayed the build-up in England and prevented attacks sizeable enough to risk attacking Germany. From Eaker's perspective the crucial factor would be the size of the bomber formations; as he wrote to Spaatz in October 1942, his senior officers were 'absolutely convinced that 300 bombers can attack any target in Germany with less than 4 per cent losses'.⁴² Not until spring 1943 did Eighth Air Force reach that level; right from the first the losses suggested that there was something substantially wrong with the American doctrinal approach. An attack on June 13 on Bremen and Kiel lost 11.4 per cent (26 aircraft) of the bombers dispatched. Heavy attacks at the end of July lost even more heavily (87 aircraft). The first use of range-extension tanks did get P-47s thirty miles further into German territory, where they did substantial damage to the attacking Germans. But it was clearly a case of too little.

It was not until its attack on Regensburg and Schweinfurt on 17 August that the Eighth Air Force discovered the full virulence of the German air defences, defences that were growing stronger rather than weaker as the Luftwaffe shifted units from the Mediterranean and Eastern Fronts to the Reich. Out of 230 bombers dispatched, the Eighth Air Force lost 60, or 10.3 per cent of the aircraft deployed in its operational units, and 17.5 per cent of its crew strength.⁴³ What needs to be emphasised here is that Eaker was still not placing long-range fighters at the top of the priorities for his command.⁴⁴

Interestingly enough, as the Eighth Air Force attacked Schweinfurt, Bomber Command refused to co-operate in bombing what Harris scornfully described as 'panacea' targets. Despite arguments from the Air Staff, particularly from its Director of Bombing Operations, Air Commodore S. O. Bufton, Harris refused to attack Schweinfurt despite the fact that the Americans had carried incendiaries to start fires that would, it was hoped, last into the night.⁴⁵ But the ideological position staked out by the two air forces prevented any real co-operation in the Combined Bomber Offensive.

The real question about the Eighth Air Force's conduct of operations in summer and autumn 1943 is not why the Schweinfurt-Regensburg raid occurred; rather it is why there was a

second one two months later. The losses in attacks throughout northern and central Germany beyond the range of escort fighters came close to destroying the Eighth Air Force as an effective fighting force. The attacks culminated in the October 14 setback at Schweinfurt and a terrible mauling. German fighters and flak shot down 60 of the attacking force, and a further 17 had to be written off, while 121 more were damaged but reparable. The loss rate was 20.7 per cent, and the damage rate 47.5 per cent.⁴⁶ The culminating disaster at Schweinfurt ended the Eighth Air Force's pretensions about being able to bomb Germany with great formations of unescorted bombers.

There were, of course, brighter areas, where the two air forces did prove adaptive and innovative – for example, in the Mediterranean in the period between 1940 and 1943. There, both air forces, in far more primitive circumstances, managed to hammer out a more realistic approach to air war and a greater willingness to work with their sister services. Sir Arthur Tedder, while not always agreeing with his army and navy colleagues, fashioned an air instrument that was responsive to their needs. The desert air force under his guidance developed a system that maximised the potential of air power within a framework of overall co-operation with ground forces.⁴⁷

Similarly, the American air forces proved more adaptable in the North African campaign to the real world; as with the RAF, the initial American development of close air support came in this theatre. More interestingly, American air commanders in the Mediterranean picked up earlier how dangerous a threat German fighters posed to unescorted bomber formations. By May 1943 General Jimmy Doolittle, commander of the American bomber force in the Mediterranean, was pressing for long-range fighters to support his medium and heavy bombers. He argued that the presence of such fighters would significantly reduce bomber casualties, while their use 'as intruders would greatly increase the effectiveness of our strategic operations'.⁴⁸

The crucial point here is that in both air forces the air commanders in the Mediterranean proved more adaptable and co-operative with their sister services. Tedder and Spaatz used their air resources in a coherent campaign to gain air superiority over the Mediterranean. Their strategic approach aimed at supporting the overall theatre objective of destroying Axis forces in Tunisia rather than promoting a cavalier 'independent' air strategy. As was the case throughout the war, air strategy was most effective when integrated into an overall strategy in which

air, land and naval forces worked closely together. Such an approach was, of course, antithetical to a substantial portion of pre-war doctrinal beliefs.

This does not mean that the Mediterranean air forces were subordinated to naval and ground forces; rather they were subordinated to a general strategic framework within which all three services worked. How does one explain the superior adaptation in the Mediterranean? Part of it has undoubtedly to do with personalities. One cannot imagine Harris being able to work with the army and navy in the fashion that RAF commanders in that theatre were able to do. But part of the answer also has to do with the shortage of resources within the theatre, coupled with a German ability on the ground that did substantial damage to the air force as well as the army. Once Rommel was loose in Allied rear areas, all the air superiority in the world was not going to protect forward air bases from the German rampages. Moreover, while the distance of these Allied air forces from the main air effort against Germany may have resulted in shortages of equipment and supply, it also forced air commanders to think in a more innovative and adaptable way. Finally, the fact that there were shortages of material as well as their force structure took some of the pressure off the Allied airmen to seek a decisive success.⁴⁹

In conclusion, let us return to our starting point. Air forces are similar to other military organisations in peace as well as in war. Therefore we should not be surprised that the RAF and the US Army Air Forces brought a peculiar mental framework into the air war, a conflict much shaped by their cultural, almost ideological, biases about the nature of war. Unfortunately, that framework substantially distorted the outlook of Allied air commanders as they set out to test the theories of inter-war air power. More often than not, pre-war theories predominated at the expense of hard, available experience. Or to use the Marxist and social-science approach to the world, when the facts failed to fit with the model, then one dispensed with the facts.

The most glaring defeat in the conduct of operations came with the rejection by both air forces of the need for escort fighters and the belief that one could minimise one's casualties (acceptable loss rates) in the face of the enemy's air-defence force while attacking targets deep within his nation. Such attitudes came close to bringing the American and British bombing of Germany to a shuddering halt in 1943 and 1944. Had the Germans been more interested in air defence these temporary

set-backs might have become more permanent, with catastrophic impact on the conduct of 'Overlord', and eventually on the post-war settlement. Ironically, Hitler and Goering displayed little interest in air defence throughout the war; to the last they remained Douhetians, firmly committed to the belief that the 'revenge' weapons, the V-1s and V-2s, were the only effective response to the Combined Bomber Offensive.⁵⁰ The 'strategic' bombing offensive, then, rendered significant contributions to the winning of the war; but its impact and success hardly reflected pre-war doctrines and preparations. And its effectiveness was diminished by the length of time that it took air commanders to shed their pre-conceived doctrinal notions and adapt to the 'real' war as opposed to the one on paper.

Notes

1. Tim Travers, *The Killing Ground, The British Army, The Western Front and the Emergence of Modern Warfare, 1900-1918*, London, 1988.
2. *Ibid.*, p. 3.
3. It is only in the last ten years that historians have begun to unravel the tactical and operational problems of the First World War.
4. Not that the French high command was any more far-sighted or willing to address the question raised by the war. See James Hogue, 'Puissance de Feu: French Artillery Doctrine, 1914-1916', MA Thesis, Ohio State University, 1988.
5. Timothy Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War*, Fort Leavenworth, 1982 suggests the learning processes of the German army in inventing modern warfare; what he leaves out is the fact that in the period 1914-16 the German army showed itself little more willing to alter its pre-war tactical conceptions.
6. Andrew F. Krepinevich, jun., *The Army and Vietnam*, Baltimore, 1986, pp. 4-5.
7. In fairness to airmen it should be noted that their colleagues in the other services have generally been no less willing to ignore the past or at least to see only in the past those lessons that do not disturb the cultural and social equilibrium. The German army might serve as a good example. While it proved adaptable and effective in learning the operational and tactical lessons of the First World War, it proved obdurately resistant to any fundamental re-examination of its strategic preconceptions, which had contributed so substantially to the Reich's defeat in that war. For a further examination of the German performance at different levels see particularly Williamson Murray, 'Clausewitz: Some Thoughts on What the Germans Got Right', in Michael Handel (ed.), *Clausewitz and Modern Strategy*, London,

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- 1986 and Williamson Murray, 'JCS Reform: A German Example?', *Naval War College Review*, 38, No. 6, November–December 1985.
8. Public Record Office (PRO), Air 20/40, Air Staff Memorandum No. 11A, March 1924.
 9. Alfred F. Hurley, *Billy Mitchell*, New York, 1964, pp. 63–83.
 10. PRO, Air 20/40, Air Staff Memorandum No. 11A, March 1924.
 11. Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive against Germany 1939–1945*, London, 1961, Vol. 4, Appendix 1, Minutes of Conference Held in the Room of the Chief of Air Staff, Air Ministry on 19 July 1923.
 12. 'Bombardment Text', Langley Field, Virginia, 1925–6. Albert F. Simpson Historical Research Center (AFSHRC).
 13. Haywood S. Hansell, jun., *The Air Plan that Defeated Hitler*, Atlanta, 1972, p. 15.
 14. 'Bombardment Text', Maxwell Field, Alabama, 1935, p. 140 (AFSHRC).
 15. Anthony Verrier, *The Bomber Offensive*, London, 1968, p. 148.
 16. See Boylan, 'The Development of the American Long-Range Escort Fighter', Dissertation, University of Missouri, 1955.
 17. Webster and Frankland, *The Strategic Air Offensive Against Germany*, Vol. 2, p. 193.
 18. Oral interview with D. C. T. Bennett, RAF Staff College Library, Bracknell.
 19. PRO AIR 16/1024, Minutes of the 20th Meeting of the Air Fighting Committee, Air Ministry, 12 March 1940.
 20. Webster and Frankland, *The Strategic Air Offensive against Germany*, Vol. I, p. 177.
 21. *Ibid.*, pp. 439–41.
 22. Hansell, *The Air Plan that Defeated Hitler*, p. 19.
 23. Boylan, 'The Development of the American Long-Range Fighter Escort', p. 30.
 24. I am indebted to Mr Ken Watman of the RAND Corporation for this point.
 25. For the general strategic framework within which the 1940 campaign fits, see Williamson Murray, *The Change in the European Balance of Power, 1938–1939. The Path to Ruin*, Princeton, 1984, Chapter X.
 26. This is, of course, what has influenced so many Anglo-American commentators in the wrong direction. The Germans termed their bomber force 'strategic', because they recognised that how one employed one's air force was an operational choice. Therefore they referred to 'strategic' bombing in terms of operations, and did not define a particular form of bombing as 'strategic'. I am indebted to Oberstleutnant Klaus Maier for this point in a lecture that he gave to the faculty of the Air War College at Maxwell AFB, Alabama in 1980.
 27. This author would argue that such an approach has substantially misled the United States Air Force since its birth in 1947 and caused it to fail to adapt to conditions of war in the real world as opposed to those on paper. For a further exemplification of this point see Lt.-Col. Barry D. Watts, *The Foundations of U.S. Air Doctrine, The Problem of Friction in War*, Montgomery, 1984. See also Williamson Murray, 'The United States Air Force: The Past as Prologue', scheduled for publication in a volume on US national security edited by Michael Mandelbaum. At the Air War College in 1980 I had a member of the faculty tell me that the German victory over France in 1940

- had to be a 'tactical' victory because it had involved the use of 'tactical' air power.
28. Sir Warren Fisher commented bitterly to Chamberlain in October 1938 on the RAF's resistance to the creation of a strong air defence system: 'When I insisted on the insertion in the report of passages such as these on the need to build up Britain's air defence system, the representative of the Air Staff acquiesced with a shrug of his shoulders.' PRO CAB 21/902, Letter from Sir Warren Fisher to Neville Chamberlain, 1 January 1938, p. 4.
 29. PRO AIR 2/2964, 17 June 1938, Air Staff Note on the Employment of Two-Seater and Single-Seater Fighters in a Home Defence War; see also AIR 2/2964, 20 June 1938, Minutes by DDops (Home).
 30. PRO AIR 2/2964, Headquarters Fighter Command, RAF Stanmore, Middlesex, 25 June 1938.
 31. PRO CAB 21/903, 18 November 1939, 'Bomber Support for the Army', memorandum by the Air Staff; see also the letter from Lord Chatfield to Chamberlain, 15 November 1939, further amplifying RAF arguments against the provision of special units for close air support of the army on the battlefield.
 32. I am indebted to Oberstleutnant Dr Klaus Maier for making available to me a xerox of the 1935 edition of *Die Luftkriegführung*, Berlin, 1935. For a comparison of the 1935 *Die Luftkriegführung* with the 1980 edition of the USAF's basic doctrinal manual, see Williamson Murray, 'A Tale of Two Doctrines: The Luftwaffe's "Conduct of the Air War" and the USAF's manual, 1-1', *Journal of Strategic Studies*, 6, No. 4, September 1983, pp. 584-93.
 33. *Die Luftkriegführung*, paragraph 11.
 34. See Williamson Murray, 'Close Air Support: The Luftwaffe Experience, 1939-1941', to be published by the Office of Air Force History in a collection of articles on close air support.
 35. Air Ministry, 'Results of Air Raids on Germany Carried Out By British Aircraft, January 1st-September 30th, 1918', DAI, No. 5 (A.IIB, October 1918), Trenchard Papers, RAF Staff College, Bracknell D-4.
 36. One should not be surprised at such British attitudes: after all, the Germans themselves blamed their defeat in 1918 on domestic revolution, particularly among the working classes, not on military collapse. It is worth noting that a substantial portion of the inter-war writings of air-power theorists carried the message that the working class could not stand up to the pounding of an air bombardment.
 37. For a further discussion of the Combined Bomber Offensive to the defeat of Germany, see Murray, *Luftwaffe*, Baltimore, Md, 1985, Chapter VIII.
 38. PRO PREM 3/31, CDS (41) *6 (B), 28.5.41, 'The Present War Situation Mainly insofar as it Relates to Air'.
 39. PRO PREM 3/19, Harris memorandum 17 June 1942. This is instead a remarkable misestimation of the role that Coastal Command would play in the winning of the war. For that effort see Sir John Slessor, *The Central Blue*, London, 1956, Chapter XVII.
 40. That decision by Marshall has remained largely in place, with the United States Navy virtually completely in charge of land-based operations over the oceans. Only in the past five years has the USAF begun to be drawn into the issues surrounding the support of naval operations at sea.

41. Thomas A. Fabyanic, 'A Critique of United States Air War Planning, 1941-1944', St Louis University Dissertation, 1973, pp. 125-7.
42. Quoted in Boylan, 'The Development of the American Long-Range Escort Fighter', p. 68.
43. See the discussion in Murray, *Luftwaffe*, pp. 166-8.
44. In fairness to Eaker, his conversation with Robert Lovett, Assistant Secretary for Air, led the latter to give the long-range fighter-escort programme strong support when he returned to Washington. Boylan, 'The Development of the American Long-Range Fighter Escort', pp. 90-1, 121.
45. Webster and Frankland, *The Strategic Air Offensive Against Germany*, Vol. II, p. 62. The British official historians, in one of their few errors, claim that 'Eighth Air Force chose a full moon period to make their first attack on August 19 [sic] and, though they carried incendiary bombs in the hopes of lighting the target for a night attack, it must have been obvious that Bomber Command could scarcely carry it out in such circumstances.' It is worth noting that on the evening of 17 August when Eighth Air Force bombed Schweinfurt, Bomber Command was over the skies of Peenemünde carrying out one of its most successful raids of the Second World War.
46. Murray, *Luftwaffe*, pp. 212-13.
47. For an outstanding discussion of British air power within the Mediterranean theatre see John Terraine, *The Right of the Line*, London, 1985, pp. 301-400.
47. Letter from Major General James Doolittle: Subject: Escort Fighters; To: Commanding General US Army Air Forces; Via: Commanding General, Northwest African Air Forces, 25 May 1943 - xerox in possession of the author.
49. It did not, of course, take the pressure off the British Army, for that service made the decisive effort in the North African and Mediterranean theatre from 1940 to 1943. Interestingly, the most adaptable and innovative forces in the British Army were in Burma, where their relative lack of supplies, material and manpower allowed them to develop well-trained, very effective forces without undue pressure. For a further examination of this point, see Williamson Murray, 'British Military Effectiveness in the Second World War', in Allan R. Millett and Williamson Murray (eds), *Military Effectiveness*, Vol. III, *The Second World War*, London, 1988.
50. See Williamson Murray, 'The Air Defense of Germany: Doctrine and the Defeat of the Luftwaffe', in *German Military Effectiveness*, Baltimore, Md., 1991, Chapter 4.

14

'The Unsung Heroes of the Air': Logistics and the Air War over Europe, 1941–1945

Robert P. Smith

In promoting strategic and tactical air power as the key to American victories in the skies over Europe, aviation historians too often overlook the role air-service commands played in supplying the tactical and strategic air forces with aeroplanes, equipment and other war-making *matériel*. Impressed by the glamour of fighters and bombers, military writers ignore air depots, mobile repair units, and supply warehouses. Fighter pilots and bombardiers people their pages; grease monkeys and supply clerks, when they appear at all, surface as footnotes or in appendices. Writing on the air war in the Second World War, Robin Higham observed that 'too much importance has often been placed on the glamorous events and too little on the sinews of war'.¹

In a speech delivered to the US Army Air War College in 1946, Major General Hugh Knerr, a leading Second World War American air logistician, described how the absence of logistical thought among his colleagues had hampered America's efforts in the early stages of the war to launch an aviation programme capable of defeating enemy air forces. Knerr told his audience that when the United States entered the war, logistics was classed in the role of 'Topsy, and we had to improvise as we went along'. Throughout history, he continued, 'victorious commanders have been those that knew logistics when they saw it'.²

The following year, Knerr expanded his argument for the *Military Review*, noting that 'too frequently in the last war we were carried away by our enthusiasm for action and neglected our logistic requirements, with the result that the action had to

be cancelled or delayed'.³ As the Commanding General of the VIII Air Force Service Command (AFSC), and later as Lieutenant-General Carl Spaatz's Deputy Commanding General of Administration for the United States Strategic Air Forces, Europe (USSTAF), Hugh Knerr played a prominent role in shaping logistics policy for the European Theatre of Operations (ETO).

Throughout 1941 and 1942, the Army's air leaders concentrated on building a well-balanced striking force with supporting units capable of sustaining operations on a scale equal to if not greater than those of the German Luftwaffe. For a peacetime air force of moderate size, this was a monumental undertaking. The real test of the Army Air Forces logistic system was how and whether it could stand the shock of war.

In establishing an American air force in England, the first step in this process, many logistical planning factors were considered. By no means self-sufficient, the European Theatre of Operations air forces faced marauding German submarines operating along the 3,000-mile oceanic pipeline over which *matériel* and equipment was shipped. To continue uninterrupted operations, depots and stations had to be stocked with sufficient war materials to meet all exigencies. From the beginning, air bases had to be constructed, depots built, planes brought to the theatre for the initial force, replacements for those lost in combat provided, maintenance crews trained, fuel stored, bombs and ammunition stocked, and thousands of spare parts made available. 'In this period of the beginnings of American air power in Europe', wrote Carl Spaatz in his 1947 Report to the Joint Chiefs of Staff, 'was also begun the development of the logistical machine which was indispensable to the success of the mission of the Eighth Air Force.'⁴

As commander of the VIII Bomber Command, Major General Ira Eaker experienced first-hand many of the early logistical problems. In a 16 September 1942 memo to General Spaatz, the Eighth's commander, Eaker cited his transportation situation as 'critical'; bemoaned the 'long time lag' between the arrival of the heavy group ground echelon and its organisational equipment, called the service groups' tables of organisation 'archaic and wholly unsuited to the task confronting us here'; described the construction programme in the British Isles as 'unsatisfactory'; and urged the Ohio-based Air Service Command to speed up the American-run fourth-echelon repair and maintenance in the United Kingdom: 'Planes not operational

due to combat injuries cannot be repaired for weeks and even months under the present system.⁵

From the beginning of operations in 1941 the US Army Air Forces (AAF) sought to devise an independent logistical system for their units. In a 10 May 1945 letter to General Henry H. 'Hap' Arnold, the AAF Commanding General, Hugh Knerr, said that 'the outstanding lesson of the air war in the ETO has been that the Air Arm must have an integrated supply and maintenance system of its own'.⁶ Knerr argued that 'the fundamental fault lay in the attempt to integrate Air Force and Ground Force supply systems' for the provisioning of common user items. The solution was to provide the Air Force with a 'self-sufficient supply system'.⁷ As early as June 1942, prior to his taking over command of the VIII Air Force Service Command, Knerr recommended that 'the Air Forces in each theater should have their own SOS⁸ extending from the port of entry to the consuming units'.⁹

In March 1942, two plans for American air operations from the United Kingdom were presented. The first called for the United States to build up air bases, depots and supplies prior to beginning actual operations. This plan would have kept the American Air Forces inoperative until the latter part of 1942. The second called for the extensive use of British facilities at the outset so that operations could be begun earlier. Under this plan the Air Forces would build their logistical system concurrently with operational activity. This latter plan was adopted because it was apparent in the earliest days that it would require a long period to develop an American logistical system capable of supplying the combat air forces.

At the core of this proposal was the Eighth Air Force, 'the first great instrument of American Strategic airpower'. Established in the United Kingdom in the winter of 1942 to spearhead a proposed Allied invasion of the continent, the Eighth tested the AAF doctrine of long-range daylight bombing. 'In this period of the beginnings of American air power in Europe', recalled its first commander, Major General Carl Spaatz, 'was also begun the development of the logistical machine which was indispensable to the success of the mission of the Eighth Air Force'.¹⁰

The availability of air bases was early recognised as a primary factor in preparing this machine for the comprehensive Air Force plan developed in 1942. The construction of these installations was hindered, however, by the shortage of British labour

and the slow arrival of engineer battalions, often without equipment, from the United States.

In June 1942, the US Army's Services of Supply (SOS) arrived in England and secured responsibility for the construction of air-base facilities, as well as other construction work. However, the aerodrome-building programme continued to experience serious delays for the remainder of the year and well into 1943.¹¹

To expedite the building of air bases, the Army's SOS permitted the newly established Eighth Air Force to handle all technical matters concerning airfield construction with the responsible British agencies. This speeded operations considerably. The increased shipping facilities made available by the abatement of the submarine menace brought more engineering personnel and equipment to the theatre, and the building programme proceeded more rapidly. The construction of air bases was tied closely to the flow of aircraft to the ETO. By the end of the war airfields in England covered more than 250,000 acres.¹²

As with the air bases, the Eighth's depot system was still largely in the planning stages. Prior to Pearl Harbor two of the three great depots that were to be the bedrock for the entire Air Force supply system in the United Kingdom had been selected. However, the shortage of labour and materials kept these, Langford Lodge in Northern Ireland, and Warton, near Blackpool, comparatively inoperative until 1943.¹³ To fill the gap, the British, after 'determined and persistent objections', bequeathed to the VIII Air Force Service Command in 1942 Burtonwood Repair Depot. Located near Liverpool, this installation was under the operation of the British, and its facilities were converted easily to American use within a short time. Burtonwood soon became the centralised repair, supply and maintenance site for all American planes in England, and was an outstanding show-case for American efficiency methods.¹⁴

By D-Day, the American construction programme in the UK was complete except for minor repair and expansion work. By the end of the war, the Eighth was operating in over 4,000,000 square feet of storage space and in 32 large depots stocked with Air Force technical supplies and allied equipment. Although most of these installations were built by British labour, using British equipment and materials, American soldier-labour contributed an estimated 140,390,880 man-hours out of the total of 405,350,640 man-hours expended in their construction.¹⁵

The supply and replacement of aircraft to the overseas air forces presented additional logistical problems. Not only was it

necessary to furnish planes to build an effective striking force, but aircraft lost in combat or damaged beyond repair had also to be replaced. The restoration of aircraft alone was a major undertaking, and adversely affected many Eighth Air Force missions. Writing to Arnold in January, 1943, Ira Eaker,¹⁶ then commander of the Eighth, remarked that 'it looks like it is really going to be lack of replacement aircraft and crews, rather than the weather, which limits the number of missions we can do'.¹⁷ That October, 214 bombers were lost; this was 9.2 per cent of all those entering enemy territory. On the Eighth Air Force's first major strike against Berlin on 4 March 1944, 69 bombers were listed as missing in action. In 1944 it was estimated that aircraft replacements alone amounted to 245 heavy bombers, 46 medium bombers and 161 fighters monthly. This did not take into account the aircraft needed to increase the combat strength of the Strategic Air Forces.¹⁸

From the beginning of the war until April 1943 the shipping space available for water transportation of aircraft was entirely insufficient to meet the needs of the combat units. At 12 October 1942 commanders' meeting General Spaatz acknowledged that 'everything gets priority [in shipping] over the Air Forces although air operations over here are of number one importance'. The following February Lieutenant-General Frank Andrews, ETOUSA Commander, spoke of 'acute' aviation shortages created by inadequate shipping; a month later, Eaker called the situation 'tragic'.¹⁹ It was not until March 1943 that any sort of aircraft-shipping policy was established upon which the Army Air Forces could depend for a reasonably stable flow of tactical planes. Consequently, flight delivery was the only method by which planes could be supplied for early operations and replacements.

This method of supplying aircraft to the combat air units was undesirable because of the limitations imposed. The wear on engines during the flight overseas frequently necessitated engine changes in the theatre, and engine overhaul was always necessary. This increased the burden on supply and maintenance facilities at the front. Regardless, from 1 July 1942 to 1 August 1943 the Air Transport Command flight delivered 10,223 combat aircraft – predominantly bombers – to various theatres.²⁰

In March 1943 a method was devised whereby tankers could transport partly assembled aircraft while carrying their primary cargo of fuel at the same time. This was accomplished by

building a meccane deck – an open steel bridge, at the level of the catwalk, extending the full length of the well deck from the forecastle to the poop deck. Although this method was ultimately abandoned because it hindered the delivery of fuel and the quick return of tankers, it did serve to supply a large number of aircraft at a critical time. Of the planes transported by water from March 1943 to August 1945, 50 per cent were shipped by tankers. The deck space used during January 1944 was equivalent to 25 Liberty ships. The ability to ship partially assembled aircraft represented a considerable saving in time and manpower, because it was unnecessary to disassemble them at the port of debarkation and reassemble them in the theatre, thus assuring the minimum delay in placing them in combat service.²¹

The aircraft-shipping programme continued to improve with the decision by the Joint Chiefs of Staff to convert Liberty vessels to aircraft-delivery ships. The flow of planes shipped by water was considerably stabilised when the Assistant Chief of Air Staff, *Matériel* and Services was given authority to schedule sailing dates and name destinations. The combination of these two factors made it possible for the Air Force to deliver planes in good condition and on time.

On 17 August 1942 the Eighth Air Force flew its first mission against the enemy with 12 B-17s. Three months later it struck French airfields with 108 bombers. By 13 May 1943 the Strategic Air Forces had 12 heavy bomb groups operational, and the following day (14 May) it laid on its first strike, with more than 200 heavy bombers. The force continued to grow in size until D-Day, when it had 40½ heavy bomb groups operational, and was able to put 2,698 bombers over the target. It dropped 4,778 tons of bombs in two missions, and was escorted by 1,966 fighters. This increase in the tempo of strategic bombing operations was in proportion to the successful development of the logistical organisation that supplied the materials of war and maintained the planes.²²

The first and most important part of this organisation, the VIII Air Force Service Command, arrived in England in July 1942. With its appearance the Air Force had for the first time the nucleus of an agency that was to supply and maintain it in combat. As Eaker phrased it in his 1 January 1944 report to the Commanding General, ETOUSA: 'The operational efficiency of the Eighth Air Force will be in large part limited and circumscribed [sic] by the adequacy and effectiveness of the Eighth Air Force Service Command.'²³

Key officers from the Service Command could frequently be found in the Eighth Headquarters War Room, listening to combat reports or studying operational and intelligence findings. The weekly Eighth Air Force Commanders' meetings, which included the Service Command, usually generated lively discussions on questions of aircraft serviceability and maintenance: 'A raid on the Continent produced an intense reaction on activities at Service Command headquarters and its depots and field installations, and showed beyond doubt how in the history of the Eighth Air Force, service and combat were inextricably woven.'²⁴

The ups and downs of the VIII AFSC were not the mere result of Eighth Air Force combat developments and administrative experience. They were also a product of the ideas and conceptions in the minds of the Eighth's commanders and other officers, as to the place logistics would take in the total picture of modern war. In the Eighth the prevailing theory was that the combat factor was predominant, and all matters of supply and maintenance were subordinate to it.

The concept current at that time which placed logistics factors last gained wide acceptance even among commanding officers. General Eaker, for example, announced at a Commanders' meeting on 14 July 1943 that the top priorities of the Eighth were designated bomber objectives and employment of the tactical air force; the service of these forces was 'subordinate though vital'.²⁵ Very few airmen held the opposing point of view, even in the AFSC. The one exception was Hugh Knerr, who wrote in a December 1942 memo:

Modern war is rapidly developing into a logistic struggle. The importance of the tactical weapon is therefore overshadowed by the supply organization which supports it. This is a consequence of the mechanization of war. This exchange of relative importance has not been fully recognized, and as a consequence the means for meeting the changed situation has [*sic*] been neglected.²⁶

While his views were never wholly accepted by the Air Force hierarchy, Knerr succeeded in impressing upon them and others the importance of logistics to the future of an independent air force. What is significant is that the history of the Eighth and its service command showed a trend, albeit a very slow one, away from the complete subordination of the 'logistical' conception to combat needs.²⁷

If air leaders failed to appreciate the relative merits of logistics in the hierarchy of decision-making, they never underestimated the essential nature of proper maintenance or the absolute necessity of spare parts to their operational strength. Maintenance operations and the supply of spare parts were significant factors in keeping the Eighth Air Force in top battle condition. Aside from the normal attrition of aircraft parts, battle damage took a heavy toll of combat planes, especially during the early days of the war. In January 1943, for example, 48 per cent of all planes crossing the enemy coast received battle damage. This continued until the range of fighters had been increased sufficiently to provide escort in deep penetrations into enemy territory. During the 459 operational days of the Eighth Air Force, the service units repaired 59,644 battle-damaged aircraft. In August 1943 slightly more than 3 per cent of the Eighth's planes were grounded for lack of spare parts, but by December 1944 only 0.93 per cent were grounded. With a projected inventory of 10,000 planes for the period, this indicated the superior work performed by the VIII Air Force Service Command.²⁸

During the early years of the war, maintenance services carried a heavy load of repair work. The desperate need for aircraft in most theatres argued strongly for repair of crippled or damaged planes. Thus air depot and service groups were strained to provide the special skills, equipment and materials needed to meet the demand. After an inspection trip to the UK in late spring 1942, 'Hap' Arnold cited the maintenance of aircraft as the Eighth's most serious problem. Ironically, Arnold's criticism came one month after Eaker, who was then the Commander of the VIII Air Force Bomber Command, wrote glowingly of his maintenance record, proudly announcing that 'to date, there has been no loss of aircraft due to poor maintenance'.²⁹ Arnold did admit a year later that the shortage of maintenance personnel and the lack of spare parts exacerbated the situation, but he took Eaker to task for refusing British help and for not requesting additional maintenance personnel.³⁰ As one possible solution, the Army Air Forces Commander suggested Hugh Knerr for command of the Eighth's logistical apparatus. Interestingly, in a 1947 interview, Knerr disputed Arnold's contention that maintenance was the ETO's 'single biggest headache', arguing instead that 'it was creating *crews* capable of performing maintenance' that affected the command's repair and maintenance activities.³¹

Knerr's subsequent arrival in the UK, and the use of an

additional 27,000 people for aircraft service early in 1943 enabled the Eighth 'to maintain more aircraft habitually in commission than we have crews to operate them'.³² The situation improved so dramatically that a War Department special consultant, who visited the Eighth in December 1943, reported to General Eaker that the efficiency of his service command was indicated 'by the fact that 75 % of your Bombers and Fighters are being kept in flying condition. This is a most wonderful record and a tribute to your maintenance and supply personnel'.³³ He went even further:

I believe that everyone will agree that 'THE UNSUNG HEROES OF THE AIR' are the ground crews who work all night repairing plane battle damage, refueling, loading bombs and ammunition, checking guns, checking and adjusting and repairing engines and instruments in order that the airplanes will be ready for another mission the following day. Were it not for the conscientious, untiring and efficient labor carried on by these men, it would be impossible for the flying crews to carry on the battle with the marvellous record they are establishing.³⁴

The problems in maintenance that persisted until 1944 were made all the more serious by a prevailing spare-parts shortage, which contributed its share to a far heavier emphasis on repair than had been anticipated or could be regarded as justified except in the context of desperate combat requirements.³⁵ As early as October 1941 Major James Doolittle, then Military Attaché in London, reported that 'the most serious immediate problem in connection with American aircraft is the almost complete absence of spare parts for our airplanes, engines, propellers, and accessories'.³⁶

Seven months later Arnold warned the Wright Field Air Service commander that 'the situation in every theater in which American airplanes are being used is becoming so serious regarding lack of spares that unless it can be corrected, production of entire airplanes must be stopped'.³⁷ The situation intensified throughout 1942, prompting an urgent missive to Washington from Ira Eaker, in which the acting Eighth Air Force commander acknowledged that he was 'faced by the serious possibility that I may have to ground all heavy bombers', unless enough spare parts were made available in his theatre.³⁸

The Eighth's first commander, Carl Spaatz, reported that from October 1942 to January 1943 'the lack of replacements in spare parts and service personnel (largely caused by the demands of

the African campaign) and the prevailing inclement weather reduced the effectiveness of the Eighth Air Force to such an extent that it was not able to accomplish any major item of the task it had undertaken'. Roughly only 50 per cent of its planes were in combat condition, and the average force dispatched on missions equalled only 60 bombers. The proportion of damaged planes rose continually, mounting from 13.3 per cent in September to 42.1 per cent in January. The strain on repair and maintenance and the necessity of modifying bombers to meet unforeseen tactical and operational conditions resulted in a high rate of abortive sorties.³⁹

As the aerial war intensified, American planes had to be modified to meet combat requirements. Until late in the war, most of this work was performed in the theatre by the service units. In 1944, for example, 13,970 aircraft of all types were modified in the European theatre. During this same period the Service Command assembled 7,479 fighter planes that had arrived from the United States.⁴⁰

The VIII AFSC devoted a large share of its effort to this function, particularly at its main air depots; it took the position very early that modifications should be done at home and not in the theatre of operations. The Eighth Air Force draft history showed, however, that one of the difficulties it had in making home-based modification a universal policy was because of the swiftly changing tactical situation. This resulted in a constantly shifting modification programme within the theatre for a large body of already delivered aircraft, rather than calling for their original modification at home.⁴¹

Interestingly, Arnold consistently pushed for at-home modifications throughout the period, admonishing his theatre commanders for ignoring him and condoning changes on a scale he considered inappropriate.⁴² He did agree, however, that there were times when theatre conversions were appropriate. It was Spaatz, however, who had to remind 'Hap' in a 21 July 1944 letter that 'there is no laboratory like the air battle. It is there that the crews get their inspirations or curse the men of little understanding who fail to meet their desperate needs. Such reactions need quick translation into mechanical reality.'⁴³

To maintain and modify the air forces in Europe required a prodigious supply network. Unfortunately, on 1 December 1942 the supply organisation of the Eighth Air Force was in a chaotic state, owing primarily to the withdrawal of *matériel* and key supply personnel for the Twelfth Air Force in North Africa. Not

only was it necessary to furnish a major portion of all available equipment to the Twelfth, but the speed at which such action was necessary also completely disrupted the organisation, and particularly the essential records of available AAF supplies in the UK.⁴⁴

During the winter months of 1942-3, air transportation between the US and the UK was seriously curtailed by weather as well as by the priority requirements of the North African Campaign. It was impossible, therefore, to obtain prompt delivery of many critical items which were holding aircraft on the ground. A certain amount of controlled 'cannibalisation' was necessary in order to meet this problem; local procurement and manufacture was resorted to in an effort to keep every aircraft in operational condition.

ETO supply improved dramatically in 1944, and prompted General Spaatz, Commanding General of the US Strategic Air Forces, Europe (USSTAF) to admit that one of USSTAF's greatest contributions to the effectiveness of US air power in Europe 'may prove to be its fight to secure an adequate flow of critical supplies at the right time. So far, despite the stepping up of the offensive, USSTAF-Air Service Command has never had to deny an Air Force any of its essential requirements.'⁴⁵

Still, it was often necessary to rely on British supplies to fill operational needs. Operational requirements and changing tactics demanded new equipment and new items. The need on occasion for such provisions had not been foreseen in the United States, so to save time and shipping space arrangements were made with the British to manufacture them. From July 1942 to June 1943 the Royal Air Force gave the Army Air Forces a total of one quarter of a million ship-tons of *matériel*, half of which went for provisioning of airfields and headquarters. Of the items procured perhaps the most important were jettisonable fuel tanks to increase the range of fighter aircraft and electrically heated flying-clothes for high-altitude missions.⁴⁶

The Strategic Air Forces in Europe were equipped through two main organisations: the Air Technical Service Command in Dayton, Ohio, and the Services of Supply in the United States and Europe. The former was responsible for procuring and distributing air-force technical supplies or those articles used only by the Air Forces. The Services of Supply furnished those items of equipment that were utilised by both the ground and air forces. They were also responsible for the shipment of supplies. Together, and in concert with the service commands

in the European Theatre, they perfected a logistical system capable of defeating Hitler's air force.

The divided responsibility in the logistical organisation presented several serious problems for the early operation and continued activity of the Strategic Air Forces. Most aviators, Knerr in particular, felt that the SOS did not adequately appreciate the fluid nature of modern air warfare, since they were geared to equip the more static ground organisations. He argued that the 'fundamental fault' with the war's logistic system was the attempt, by the SOS, to integrate Air and Ground Force supply systems for the provisioning of common user items: 'This has meant Air Force dependence upon a system geared to Ground Force experience, requirements, and tempo of operations.' As a result, the Ground Army failed to 'appreciate and anticipate the requirements of the Air War.' Contrarily, 'where supplies have been under Air Force control from their source in the Zone of Interior to the using unit in the Theater, our supply system has proven to be completely effective'. The solution, argued Knerr, rested 'in providing the Air Force with a self-sufficient supply system'.⁴⁷

These arguments over the AAF's independence in operating its own supply programme – from the placing of contracts to the delivery of *matériel* at forward combat bases – dominated the whole period from 1940 to 1945, and played a major role in the Army Air forces becoming a separate military department in 1947.

On 17 April 1945 General Spaatz announced from Headquarters, US Strategic Air Forces in Europe that the air war against Germany was over. Two years later, in his report to the Joint Chiefs of Staff, the general acknowledged the large part played by Air Service in achieving this great success. Air Service, he wrote, 'made it possible for the planes to fly, filling their tanks with gasoline, loading them with bombs, repairing damage, and rendering the dozens of services that left airmen free to devote their full time to bombing and fighting'.⁴⁸

Air operations in Europe demonstrated with probably greater force than ever before the extent to which logistics factors entered into all strategic and tactical planning. Arguing persuasively that the Second World War was 'the first war effort fought by the United States on a truly global scale', Robert Coakley, an Army logistics historian, noted that 'in this light, strategic and logistical planning were two sides to the same coin'.⁴⁹ The time has come, therefore, for Second World War

aviation historians to recognise and properly to record the logistical side of the coin.

Notes

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2. 'Strategic, Tactical and Logistical Evaluation of World War II', Hugh Knerr, Air War College, 29 October 1946, Office of Air Force History (AFCHO), K239.7162.46-18.
3. Letter to Col. Naidall, Editor-in-Chief, *Military Review*, 5 June 1947, Spaatz Papers, Box 276, File: Papers of Hugh Knerr, Library of Congress, Manuscript Division (LCM).
4. General Carl Spaatz, 'U.S. Strategic Air in World War II', 1947 Report to the Joint Chiefs of Staff, AFCHO 106-94, Pt. 1, Vol. 2.
5. Letter to Commanding General, Eighth Air Force, from Maj. Gen. Ira Eaker, Commanding General, VIII Bomber Command, 16 September 1942, Eaker Papers, Box 16, File # 104, Vol. II, LCM.
6. Letter to Commanding General, Army Air Forces, from Maj. Gen. Hugh Knerr, Deputy Commanding General for Administration, USSTAF, 10 May 1945, Arnold Papers, Box 116, File: SAS 400, ETO and MTO, LCM.
7. *Ibid.*
8. SOS or Services of Supply (later the Army Service Forces) furnished those items of equipment that were used by both the ground and air forces.
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11. 'Notes of Minutes of Meeting on Accommodation of the U. S. Air Forces in the United Kingdom', 28 May 1942, Eaker Papers, Box 16, Vol. I, File # 82, pp. 16-21. See also Memo to Robert Lovett, from Arnold, 27 April 1942, Arnold Papers, Box 49, File # 229, LCM.
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13. *History of the VIII Air Force Service Command, 1942-1943*, Chapter 1, 'Mission', AFCHO 519.01, 1942-5, Vol. 3, Chapter 1. See also 'Notes of Meeting on Accommodations', 28 May 1942, Eaker Papers, Box 16, LCM. See also Interview, Maj. Gen. Henry Miller and Dr Bruce Hopper, Eighth Air Force Historian, 8 October 1943, Spaatz Papers, Box 136, File: Interview Miller, H. J. F., LCM.

14. Letter to Commanding General, Eighth Air Force, from Brig. Gen. Hugh Knerr, Deputy Commanding General for Administration, USSTAF, 1 March 1944, Hugh Knerr Papers, Box 3, File: Book C-5; 'Notes of Interview with Major General Hugh J. Knerr, Secretary, The Air Board', 24 November 1947, AFCHO K239.0512-616. See also Memo for Robert Lovett from Arnold, 27 April 1942, Arnold Papers, Box 49, in which Arnold recommended that the British give Burtonwood to the Americans. See especially Letter to Arnold from Spaatz, 5 July 1942, Arnold Papers, Box 49, File # 228, LCM, in which Spaatz laid out his plans for depots and aerodromes in the UK.
15. Spaatz Report to the Joint Chiefs.
16. Throughout his tenure as the Eighth's commander Eaker was under great pressure to get more missions out. Arnold also criticised Spaatz for the same reason.
17. Letter to Arnold from Ira Eaker, 30 January 1943, Arnold Papers, Box 48, File # 226, LCM. See also Memo for Lt.-Col. Clarence McMullen, from Arnold, 19 January 1942, Arnold Papers, Box 43, File: Inspections.
18. Kit Carter and Robert Mueller, *The Army Air Forces in World War II. Combat Chronology, 1941-1945*, Washington, 1973, p. 285.
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21. Memo for Mr Harry Hopkins, Special Assistant to the President, from Arnold, 19 May 1943, Arnold Papers, Box 123, File: SAS Cases 831-980, # 872, LCM.
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37. Letter to Maj. Gen. O. P. Echols, Chief, Matériel and Services, Army Air Forces, 4 May 1942, Arnold Papers, Box 46, Case # 181, LCM.
38. Letter to Arnold, from Eaker, 11 December 1942, Arnold Papers, Box 131, Case # 160, LCM.
39. Spaatz Report to Joint Chiefs.
40. For modification, see Army Air Forces Regulation, 65-15, 'Supply and Maintenance', Modification of Aircraft, 30 June 1943, Spaatz Papers, Box 57, Folder: Aircraft Modification, LCM; and Virginia G. Toole, *The Modification of Aircraft: Procedures, Policies, and Problems*, 22 May 1945, AFCHO K201-4.
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15

Commentary

Alfred Goldberg

To deal with the set of chapters bestowed on me for commentary, I shall have to touch on all of the major air forces of the Second World War. In keeping with the injunction to essay comparative historical analysis, I shall try to elucidate resemblances and essential differences between the air forces, especially those factors of significant consequence then and since. I propose to look at several main themes: doctrine, top echelon command, operations and logistics (they belong together), and research and technology.

Doctrine is rooted in tradition and experience, usually of the last war, in technological progress, in theory and imagination, in the mixture of cultural and ideological biases referred to by Williamson Murray, and, of course, in wishful thinking. It is a much-abused term, and often means no more than a temporarily prevailing notion or a strategic concept rather than a prescription for thought and behaviour.

The strategic bombing doctrine cherished by the British and American air forces in the 1930s had no concrete manifestation in forces before the war began because the resources were never made available for the technology, manpower and bomber squadrons needed for practical application. Had Baldwin and Chamberlain put up the money so that the RAF had a thousand combat-ready Lancasters in September 1939, would Germany have been deterred from beginning the Second World War at that time? Would it have paused to reassess its policies and strategy and reconfigure its forces – especially the Luftwaffe? Despite Goering's boast that 'if a single enemy bomb falls on Berlin then my name is Meier' the German air leaders, too, generally believed that the bomber would always get through.

The authoritarian powers could take long steps toward converting air doctrine into deployed forces before the war because

they had fewer internal constraints and more specific military initiatives in mind. German and Russian air doctrine, although attracted to the strategic bombardment concept, had to take into account support of the ground forces because both countries were continental Powers and correctly envisaged that they would have to wage extensive ground war. As it turned out, the demands for air support of the ground war became too massive and insistent to permit the Germans and Russians to create large-scale strategic bomber forces. Thus the doctrine of combined air warfare inevitably and increasingly dominated Soviet and German air operations.

Japanese air doctrine, especially that of the powerful naval air arm, derived from Japan's position as an island maritime nation dependent on the sea lanes. The long-term strategic concepts that called for expansion of the island empire to the south and west dictated a doctrine emphasising long-range naval power for the control of the ocean and lines of communication. This doctrine and strategy of offensive warfare required advanced Pacific island bases, and above all, powerful carrier striking-forces. Neglected was the need for effective anti-submarine forces.

As in Japan, naval air doctrine played a significant role in the United States, and to a lesser extent, in Britain, where naval air suffered from subordination to the RAF in the pre-war years – a handicap from which it never fully recovered during the war. The Anglo-American anti-submarine war against the U-boats in the Atlantic would no doubt have been effective earlier – by perhaps as much as a year – had sufficient long-range bombers been made available for the purpose by the RAF and the AAF. The failure to appreciate the submarine menace reflects a lack of strategic perception by the two air forces. In the United States, Navy air doctrine, directed primarily at Japan, emphasised the same elements as the Japanese Navy – an offensive strategy based on aircraft-carriers, Pacific island bases, sea-trains, and secure lines of communication. Given this doctrine and the independence of naval air in both countries, it is not surprising that the carriers played a dominant role in much of the Pacific.

The high command of the air forces, in general, before and during the war, embraced the pre-war strategic bombing doctrines of their services. Nevertheless, in the United States and Britain, the air commanders had to meet the Army requirements for air support of ground operations no matter what their doctrinal preferences. The USAAF responded more quickly in

this regard, if only because it was still subordinate to the Army. The British air marshals in London and in the field exercised more authority and initiative than their American counterparts, and certainly more than their Soviet and Japanese counterparts, and probably more than the German air leaders. In fact, in spite of Goering's efforts to assert the independence of the Luftwaffe, it was increasingly dominated by the demands of the Army. Only the Battle of Britain in 1940-1 represented a prolonged independent large-scale strategic action by the Luftwaffe. The Red Air Force high command in pre-war years was distinguished by its high turnover rate, thanks to Stalin's persistent purges of his top military leaders. The subordination of the air force to the Red Army limited the doctrinal and operational initiatives of the air leaders and kept them firmly tied to Army requirements. The competition, duplication and suspicions between the Japanese Army and Navy air arms undoubtedly hastened their defeat. The leaders of the Japanese Army air arm, subordinate to the ground commanders, found themselves circumscribed and much less able to influence the course of the air war and the overall conflict than their American counterparts or Japanese naval air leaders. It is only fair to observe that the great disparity in resources, material and human, available to the two contending air forces accounted in no small part for this difference.

As an instance of near-operational disaster resulting from over-rigid adherence to doctrine, Williamson Murray raises the frequently raised issue of the failure of the American air leaders to accept the need for a long-range escort fighter and to have it available in time for the strategic air offensive against Germany. As he pointed out, this adherence to doctrine has been a not uncommon failing of air leaders in Britain and the United States, and for that matter of those of the other combatants also. There had been no real experience of strategic bombing against substantial flak and fighter defences, and the subject remained in the realm of theory and imagination. The American notion that bombers could defend themselves against fighters was in the mainstream of thinking about air war - the British, Germans (until 1938 at least), Russians and Japanese, when they addressed the question of strategic bombing and escort fighters, expressed no different views. This is not to excuse the American air leaders: it is to place in context their failure to understand the dimensions of the problem until they had been bloodied by a year of combat experience. Recognition of the need for escort began, of course, much earlier than the autumn of 1943, for the

long-range fighter became available in numbers early in 1944: production of aircraft and training and deployment of combatants on a large scale do not occur in a few months. In truth, air leaders manifested a growing ambivalence on the subject from the autumn of 1942 on, and even while affirming the capacity of the bomber to defend itself, they sought to provide the fighter protection that became increasingly and obviously necessary. Even while talking one way, the air leaders were hedging their bets. Fortunately, from their standpoint, they were in time to remedy the situation.

What would have been different had long-range escort fighters been available a year earlier? Would it have changed the course of the war? Would it have been possible to bomb Germany into submission before D-Day? There is no certain answer to these hypothetical questions. We should keep in mind that bomber strength remained limited throughout 1942-3: most of the US bomber build-up occurred in the first five months of 1944. Certainly more damage could have been inflicted on German industry, and the Luftwaffe would have had to build up its air defence of the Reich earlier than it actually did, thus probably depleting the strength of its forces in Russia and the Mediterranean and thereby possibly affecting adversely German operations in those areas. This is, of course, an exercise in 'what if?'. There remains still the question whether the strategic bombing doctrine *per se* was invalid, or whether it might have proven itself had optimum circumstances prevailed from the beginning of the war.

Perhaps the most striking difference between the winners and losers in the war was their attitude towards and execution of the logistical function. The Anglo-American air leaders, some of whom had acquired technical expertise during the pre-war years, had a better understanding and appreciation of logistics and technology than did the German and Japanese top combat commanders. The latter's neglect and underestimation of many of the most important and indispensable functions that had to be performed on the ground bore out Liddell Hart's pronouncement that 'the large ground organization of an air force is its Achilles' heel. The German and Japanese air leaders must accept much of the blame for technical deficiencies, and little credit for technological initiatives and advances.

Fundamental to the conduct of the air war by the contending air forces was their conception of the nature of the war - particularly its duration. The Germans and the Japanese anticipated and

planned for 'short wars' that did not require full mobilisation of their industry and manpower. The victors – the British, Americans and Russians – by contrast all recognised from the beginning the probability of a long war of attrition and the enormous requirements that would ensue. It is true that the Russians and British, defeated in the early stages of the war, had little choice but to prepare for a long war, and the Americans profited from their experience. The German waited until 1942 to begin a genuine mobilisation, and the Japanese until 1943. By then it was too late for both of them.

After the Soviet Union and the United States entered the war, the Germans and Japanese found themselves utterly over-matched. The margin of difference in the air was greater than generally realised. Anglo-American and Soviet output of aircraft and combat crews dwarfed German production in 1942–5. The German and Japanese air forces were done in by a crushing weight of men and *matériel* they could not hope to match. Moreover, with some exceptions, they lost their qualitative advantage of the early years, and were thus doubly disadvantaged.

The industrial victory of the Allies on the home front had its counterpart in the field, where the rhythm of war was dependent on logistical factors that determined the timing and the mass that could be applied. The war on both the Eastern and Western fronts was distinguished by the remarkable logistical mobility and improvisations of the air forces in support of the ground war. Rapid movements back and forth across vast distances greatly tested the capacity of the logistical systems, and determined the operational effectiveness of the air forces. The Luftwaffe was at a great and growing operational disadvantage in this war of mobility because technical and logistical resources were inadequate to the task, and became increasingly inferior to those of its opponents. The provision of huge numbers of air bases and flying fields required enormous construction efforts that used up immense resources. By contrast with the continually changing bases of the tactical air forces of all of the combatants on the Continent, the 150 to 200 bases of the Anglo-American strategic air forces in Britain and Italy remained static during the war. Robert P. Smith's paper entitled *The Unsung Heroes of the Air: Logistics and the Air War Over Europe, 1941–1945* unfortunately does not take into account this vital aspect of air logistics. The paper is concerned almost entirely with the 1942–3 Eighth Air Force, doesn't mention the Fifteenth

Air Force, has little to say about 1944-5, and seems to be unaware of the climactic tactical air war on the continent.

At the beginning of the logistical process the primary impulse is technology – research, development and testing of new weapons and munitions. The technological competition during the war went far towards determining the quality of the air forces, for the performance, durability and maintainability of the aircraft, their weapons and the ever more pervasive and vital electronics devices are a prime measure of judgement and quality. Any such measure must, of course, also take account of training (extremely important), leadership, strategy and tactics. Because they had prepared for and intended offensive war, the German and Japanese forces had better-quality aircraft in the early stages of the war than did their opponents. Their success must also be attributed to high-quality training of air crews and the successful use of surprise. Thus the Luftwaffe was able to offset the Soviet quantitative advantage in 1941-3: thereafter the quantitative odds were increasingly adverse, and the quality gap narrowed and finally disappeared, as Von Hardesty points out. In the Pacific, the Japanese lost their qualitative advantage even more quickly, and from 1943 on found themselves smothered by US land and naval air power.

In the air war in Western Europe, German technology could not achieve a qualitative advantage sufficient to offset the overwhelming Anglo-American superiority in numbers. The jet fighters were too late and too few, and had too many deficiencies. The V-weapons also came too late to exercise a decisive effect, and the search for the atomic bomb came to naught. The combination of mass production and continual improvement in the quality of aircraft and weapons by the Americans, British and Russians constituted too great a disadvantage for the German and Japanese air forces to overcome.

The air war in 1939-45 reminds one of the tale of the hare and the tortoise. The analogy is far from precise, for the Allied Powers were far from being tortoises. It is clear that in 1939-42 the Germans and Japanese, and their air forces, ignored the chief lesson of the First World War – that war between Great Powers was more likely to be a marathon than a sprint, and that the circumstances of the race would be subject to immense transformations. Eventually, the Axis powers ran out of fuel and had to abandon the race. In the home stretch – the last two years of the war – the Allied Powers made the rules, and he who makes the rules wins the race.

PARTV

Air Warfare and Humanity

16

The Strategic Air War and its Impact on the German Civilian Population

Olaf Groehler

Bombs arouse bitterness and hatred, they give rise to resentment and animosity. They have provoked more accusations and mutual denunciation than any other occurrence in recent military history. The bombing operations led to an infinite number of biased interpretations and explanations, which served as self-justification and excuses, and therefore got lost in a blind alley at a certain point.¹ Thus there cannot be just one answer to the question of what the air raids which shook the very foundations of large segments of European society in the Second World War really were. This air-to-ground war had many facets. From the bomber pilot's point of view it was completely different from the experiences of the victims of high-explosive and incendiary bombs. While altitudes of seven to eight thousand metres or the impenetrable veil of night separated the pilot from the nature of his mission, millions of people in most of Europe found this kind of warfare to be the most drastic and threatening disruption of their accustomed way of life, and it destroyed the notion they had previously held of war. Aerial warfare confronted countless Europeans and Asians with an abrupt, merciless and brutal destruction of a traditional image of war still oriented toward the basic notion of a tamed Bellona in spite of the increasingly comprehensive forms the 1914-18 war had taken.

This concept of war was still oriented, in spite of everything else, towards what was left of enlightened thought and declared international law, and had firmly established the differentiation between combatants and non-combatants to be found in international law. With the air raids these delimitations were irretrievably erased. Those who had previously been seen as non-combatants living far away from the front suddenly found

themselves at the epicentre of fierce fighting, while all that military personnel in remote garrisons saw of the world war were newspaper articles. What had enjoyed the reputation of being the safest area was now frequently seen as a perilous region. What had been instilled in millions of soldiers of all continents and nations throughout centuries as the motivation for serving at arms, namely that their military service was meant to protect their home, hearth and family, had become obsolete and questionable overnight. Not just the man on the battlefield, clad in field grey or khaki, was exposed to an acute threat to his life, but so were all those who linked him with a thousand fragile bonds to his civilian existence.

This disruption was felt deeply by all European peoples involved in the Second World War. Its marks are still there today, whether in the recollection of the war generation or in the minds of several post-war generations shaped by accounts and reports. The most vivid memories of this war were imprinted into the memory of the Germans, who had been hit the hardest in the air raids in Europe which resulted from the war started by the Third Reich.

Maybe the Germans also experienced the reality of the new everyday life of war as the greatest challenge. Spared for one-and-a-half centuries from the direct physical experience of the horrors of war in their own country, now victims of fanatic chauvinist manipulation repeatedly announcing that the final victory was imminent, it was the appearance of Allied bomber fleets in the skies of this great German empire which swept away many of the illusions concerning the war, the constellation of power and the eventual outcome.² If the majority of the deluded people heard the nightly sound of British Wellington bombers in 1940-1 as merely the impotent reaction of a people on the verge of collapse, British and American bombers soon subjected the people in the major urban areas to fear, horror and finally utter desperation, leading them to admit they would rather subsist on nothing but bread than continue to endure this sheer endless horror.

During these dreary, bleak and hopeless air-raid nights the inhabitants of the large German cities developed an almost Pavlovian reflex of fear, which was released when the howling, wailing acoustic signal of the air-raid sirens announced an attack. Even today, their sudden howling will abruptly recall for several seconds the buried memories, recall for a moment the tense atmosphere of nervousness and uneasiness which used to

take hold of most people between the wailing of the sirens and the low humming noise of the approaching bombers.

Therefore it is not surprising that the subject of bombing operations has been discussed in a more controversial fashion than any other, since the views taken of it depend on the point of view and the experiences of millions of Germans. In hindsight, one cannot help but see indications of a lack of discernment and inadequate historical perspective.³ This is mostly related to the question of cause and effect, of guilt and responsibility.⁴

More recently, it has been disputed whether the horrendous devastation on the Continent and the immense number of civilian casualties during the Second World War are to be attributed primarily to rampant military technology, disfiguring a continent in blind rage, crushingly and by mass extermination. But those who see the root of all evil solely in the fact that a fetish was made of arms technology, blind themselves to the real causes of what went on. In spite of the tremendous surge in destructive power, these causes are not only found in the sector of arms technology, but must be sought primarily in the social and political climate of the day. Arms technology is always merely an aid to strategy, and as such a political instrument. Therefore anyone who seeks to arrive at a correct interpretation of the bombing operations is heading down the wrong path if his approach to interpretation is exclusively based on the technological aspect. Political purpose and political intention must also be taken into consideration.

In this respect, the dispute in military historiography, over decades, on who really is to blame for the beginning of the air raids, who dropped the first bomb, seems somewhat beside the point. A group of historians is still seeking to cast doubt on the historic responsibility of Nazism for unchaining terror bombing against the civilian population with the argument that the structure, the organisation and principles of the German Air Force made it a service set up primarily from tactical considerations, unable already as far as its equipment was concerned to conduct a strategic air war against major cities as targets.⁵ Extreme right-wing publications even present the undisputably terrorist acts of Goering's bombers as a series of unfortunate accidents and circumstances, for which eventually no one was to be held responsible.⁶ The overused terms 'accident' and 'unintentional' are to be seen, however, in the light of names like Guernica and Warsaw, Rotterdam and Belgrade, which were to remove the last shade of doubt in the Western world between 1939 and 1941

as to the tasks the Luftwaffe was devoted to in war.⁷ It does not help much under this aspect to show in retrospect that opinions were divided within the Luftwaffe leadership on the tactical and strategic components of aerial warfare, although one should be careful not to underestimate the influence of the faction which was determined to engage in radical terror warfare.

The world public in 1939-40 basically had to judge the Luftwaffe by how it presented itself, not by its internal attitudes. And it projected an image of itself also in its propaganda, including a film ('Baptism of Fire'), as a well-adapted instrument of terror bombing, striving for the achievement of political and moral effects by its operations. It was part of the German concept of aerial warfare in 1939 to make such an impression and demonstrate it in practice. The world public of 1939 could hardly differentiate between tactical and operational bombing, and the question arising here is whether tactical requirements might frequently have been used as a pseudo-justification for operational considerations. If, for example, one analyses the events leading up to the bombing of Warsaw,⁸ one cannot but recognise, in my opinion, the pretext employed to justify the air raids. As early as 10 September 1939 the Luftwaffe General Staff, using their own wide interpretation of the reprisal concept, ordered: 'The attack is to be regarded as retaliation for the crimes committed against German soldiers, and its objective is the destruction of "Wasserkante". It will be important to achieve extensive destruction in the densely populated parts of the city during the first attack.'⁹ And, in the end, Luftwaffe General (Fliegerführer z. b. V.) Wolfram von Richthofen got approval for bombing Warsaw not because of tactical considerations for the battle on the ground, but because of the request he submitted on 22 September 1939: 'Urgently request exploitation of last opportunity for large-scale experiment as devastation and terror raid. . . . In case Fliegerführer z. b. V. is assigned this task, every effort will be made to completely eradicate Warsaw, especially since only customs office at border in future.'¹⁰ There is no doubt in my mind that there was no relationship between the alleged intended military purpose and the actually intended effect, and this allows the conclusion that those who attributed to the bombing of Warsaw characteristics far in excess of what was to be expected of its superficially tactical nature were, indeed, not wrong.

This is confirmed by the Luftwaffe leadership's investigations and generalisations on the effects of its bomber attacks in Po-

land, in which exactly the same method was used which would cause the devastating blazes which ruined many major German cities years later. On 28 November 1939 the effects of the incendiary bomb B 1 Fe were described: 'Its excellent effect against urban residential buildings is beyond doubt after the great success of Warsaw. . . . Drop in large numbers to create as many fires as possible at one time. Additionally, attacks in waves with HE or FRAG bombs . . . to keep the population in the shelters, thus allowing the individual fires to expand and cause a disastrous blaze.'¹¹ The Nazi leadership was well aware of the danger of such a course, as a comment of 18 May 1940 after the bombing and devastation of Rotterdam shows. It says: 'If you want to make propaganda with the aim of saying: Look, how strong we are, how efficient our Wehrmacht is, these are the effects of our arms and bombs, then no other target is better suited than Rotterdam. However, if you want to avoid being continuously branded as cultural vandals, then a visit to Rotterdam is dangerous. But since world history always sides with the victors, this probably need not worry us [too] much in the future.'¹²

Aerial warfare as begun in 1939, undoubtedly tending towards intentional inclusion and application of its indiscriminate elements, is documented by an after-action report of the 4th Air Force of 9 October 1939, beginning the evaluation of the bombing of Warsaw with the following statement: 'In this attack, total war was implemented for the first time.'¹³ The key to the bombing concept of the Fascist Reich, equally threatening the armed forces and the civilian population, is to be seen, in my opinion, in this affinity to the ideology of 'total war' found among the Luftwaffe General Staff and the Luftwaffe supreme headquarters. The realisation and practise of the gospel of total war were intimately related to 30 January 1933, which also was a kind of pointer towards the genesis of bomber operations. Pointing at analogous concepts of strategic bombing in Great Britain, the United States, Italy or the Soviet Union is no excuse. Because the establishment of the Fascist dictatorship in Germany changed one crucial prerequisite: the previously primarily academic discussion of total war and bomber operations gained a potential of endangering whole peoples through the new German rulers' warmongering policy. To an ever greater degree the speculative possibility turned into gruesome reality!

The decisive prerequisite for this step towards a new dimension of evil was the thoroughly and completely cynical relationship

of the Nazi rulers to peace. In the Fascist heresy of total war, the concept of peace was negated, instrumentalised and rendered inapplicable in all possible ways. Whether the aims of war were realised by air terror as a means of coercion and intimidation or of threat and blackmailing used in cold blood, or whether one made use of other techniques of depopulation, in which air terror was more or less only a preliminary step towards completely extinguishing whole segments of the population or even whole peoples, was of subordinate importance. What was decisive was the principle of conducting the war in such a way that all boundaries between civil and military reality were consciously erased.

The consequence of such concepts and actions was disastrous for the civilian population of Europe and Asia. While among the 10 million dead of the First World War some 500,000 were civilians, the losses among the civilian population surged in the Second World War, with a total of 50 million dead, to at least 25 million dead, and more likely 30 million dead among civilians. Expressed as percentages, that meant their ratio climbed from about 5 per cent to over 50 per cent! In other words: only in the wars of the present did more civilians die than soldiers, did the dreadful tendency emerge that modern wars bring more death to the unarmed civilian population than to the members of the armed forces.

This was due primarily to the barbaric occupation regime and the policy of Fascist genocide, mostly in Eastern Europe. But next came the air raids, taking a hitherto unimaginable toll of lives among the population. Indeed, aerial warfare operations proved that 'aerial warfare is the kind of war which, most of all, hits the non-combatants directly'.¹⁴ It is also some proof of the embarrassment of the historian in familiarising himself thoroughly with the conditions which cause these forms of war that the numbers of losses among the civilian population have remained blurred and hazy to date, as opposed to the very precise accounts of military losses. In many countries, only vague estimates of the losses among the civilian population during the air raids exist. But even taking into consideration all these inaccuracies, one arrives at a total of at least one and a half million victims of bombing operations in all parts of the world.

This is probably the most terrible 'growth rate' between the First and Second World Wars, if one recalls that during the First World War some three thousand people lost their lives in aerial bombardments.

This five-hundred-fold increase of mortality becomes understandable if the bomb-loads of the Second World War are considered. All in all, some six and a half million tons of bombs were dropped all over the world between 1939 and 1945. To get an idea of the relation to the First World War, let us recall that the German air force dropped 27,000 tons [*sic!*] of bombs between 1914 and 1918. The Luftwaffe, on the other hand, dropped about 1.3 million tons. The British bomber fleet dropped 595 tons of bombs on targets far behind the front in the First World War, and over 840,000 tons in the Second World War.

It was above all German territory which attracted most of the bombs – that of the very country which with its aerial warfare operations from 1939 to 1942 sowed the wind which later as a terrible storm devastated the major German cities. It was German Fascism that gave to a shocked world the horrible phrases 'to Coventry', to 'erase' cities.

In view of this, who could blame the peoples of Europe, fighting for their independence, their freedom and also their physical existence, that they endeavoured to eradicate Nazism, which was bringing the fury of war to country after country; that they did all they could to destroy the Fascist terror machinery, its armed forces and the military potential which provided the resources, if possible already in the country of origin – to shorten the war. Who could not share the feelings of Czechoslovak, Polish, Norwegian, French and British pilots or of the members of the Soviet long-range air forces, who did their utmost to avert from Europe and the world the danger of Nazi oppression and barbarity, and who wanted to prevent Europe from turning into one gigantic Third Reich slaughterhouse and torture-chamber? Czechoslovak pilots serving with the British Bomber Command wrote on their bombs in July 1942 for attacks on Bremen the slogan 'For Lidice'.

Self-pitying comments by German historians on the horrors of the air raids all too frequently overlook the fact that it was only the policy of Nazism which brought this fate upon German cities, and that the powers of the anti-Hitler coalition had good moral and political reasons to counter the Fascist Modes of Warfare even in this way.

As the British and American bomber operations recoiled with full force on Germany in 1942–3 they hit culprits and their confederates, but also innocent people. Modern destructive technology has, indeed, created an insoluble contradiction – i.e.

a destructive potential which pulls everyone against whom it is applied into a maelstrom of devastation, and which renders all restrictions, laws and rules of international law secondary and ineffective.

The strategic air raids of the Second World War spared neither the fighter in uniform nor the unborn, neither the armament-industry worker working overtime nor the disabled pensioner.

To get an idea of the dimension of aerial warfare against the civilian population, let me first mention that the Greater German Reich had about 80 million inhabitants when the Allied strategic bomber operations began, with 26 million of them (almost one-third) living in about 60 cities of more than 100,000, as of 21 June 1943.¹⁵ These big-city inhabitants were the primary target of Allied aerial operations. Thus, right from the outset, they were directed against selected groups of the population, belonging above all to the big-city proletariat, the lower middle class and the intelligentsia. Only to a minor extent was the agrarian population in the broadest sense affected by the direct air raids.

If one studies the effects of aerial bombardment on these three main categories of the urban population, different consequences can be found. Bombing operations affected the civilian population most directly in the following ways:

1. due to the destruction of living quarters, personal property and jobs;
2. due to the forced separation of families in evacuations;
3. due to the relocation of industry;
4. due to the increased burden of everyday activities as a result of the destruction of urban infrastructure;
5. due to the daily threat to the life of each and every individual; and
6. due to the cumulation of all these factors, reflecting on the mood, attitude and morale of those affected.

In principle, aerial attacks affected all these classes and social strata in much the same way, but with major differences in the ways these effects were overcome.

Numerically most strongly affected by aerial attacks were the workers concentrated in large plants. Possibilities to switch to other jobs were minimal in the Third Reich, and the same applies to finding cheap housing. German workers during the war were very much tied to one place and rarely able to seek, on

their own initiative, regions less hard-hit by bombings. Theoretically, they should have suffered the highest losses and casualties. This tendency was countered, however, by the fact that the large industrial enterprises especially had set up a comprehensive network of air-raid shelters already in advance of the Second World War. This fact – and not primarily inaccurate air raids – explains why the losses among skilled workers in the German armament industry were far less than the Allies thought after 1945.¹⁶ In addition, plants especially endangered by raids were relocated at an increased pace from 1943 to areas not yet affected by air raids. In January 1945 the total number of workers involved was not less than 841,000.¹⁷

The relatively good protection most large plants could offer their employees at work was in harsh contrast to the protection in residential areas. The bunker construction programme established in October 1940 included 79 cities and communities of military importance, mostly in the Ruhr area and Westphalia, which received almost 45 per cent of all constructed bunkers.¹⁸ Individual cities such as Emden, Bitterfeld, Rheinhausen or Siegen, by means of this programme, succeeded in providing bunker space for 23 to 24 per cent of their population. In the majority of big cities affected by the air raids, however, just some four per cent of the inhabitants could hope to get a bunker space. In late summer 1943 the 19 million inhabitants of those cities affected most by air raids had bunker space for 740,000; 11.6 million found refuge in splinter-protected air-raid shelters, and 6.5 million were left without any protection whatsoever.¹⁹ The protection afforded above all to the population of the cities in the Rhineland and Westphalia was, however, at the expense of other big cities which remained without any major air-raid shelter construction, such as Dresden, Chemnitz, Darmstadt, Nordhausen, Plauen, Cottbus, Pforzheim, Halberstadt, Würzburg, Hildesheim, Potsdam and others, and thus suffered high or extremely high losses among the civilian population in the 1944–5 British or American air raids. Indeed, the equation holds in almost all cases: those cities which went unattended to in the bunker-planning of 1940, and did not witness the fire storm until 1944–5 were among those with the highest numbers of losses among their populations. This was because, since 1943, the bunker programme for the civilian population had been suspended owing to the extension of the Atlantic Wall or the Eastern Wall and large-scale underground construction for central armament factories. The civilian programme's share in con-

struction volume dropped from 13.5 per cent in the fourth quarter of 1943 to 1.3 per cent in 1944 and 0.7 per cent in 1945.²⁰

Therefore, lacking the concrete required for the civilian population, the leadership of the Third Reich turned more and more to the evacuation of those parts of the urban population regarded as superfluous. The Ministry of the Interior calculated, in June 1943, that it would be necessary to evacuate 25 per cent of the 26 million people in big cities living under the threat of air raids, which meant moving 6.5 million people to rural areas or small towns.²¹ Initially, the programme comprised the relocation of 3 million people, of whom 1.5 million were from the Rhineland-Westphalian area.²² This evacuation did, however, create social tension, because the majority of the evacuated city residents with their characteristic way of life could not get used to the very crowded and frequently primitive living conditions they found at their new places of residence. The native residents, on the other hand, saw the evacuees as unwelcome, unwanted people in search of quarters, who demanded much and did not give anything in return.²³

So, in the war years, especially from 1943 on, a kind of mini-exodus developed in Germany, involving about 6 million people evacuated as a consequence of the air raids, and often moving back and forth between their old and their new homes. A demographic shift of such great magnitude, with the consequences still felt and registered today in a variety of regions in both German states, had not occurred previously in recent German history. The main areas of evacuee resettlement were Saxony, with 1.2 million evacuees, Württemberg, with one million, and Thuringia, with 800,000. This figure is also another explanation for the extreme losses suffered in Saxony in 1945, because its cities and towns, referred to as late as 1943 as 'the Reich's air raid shelter', were literally overpopulated, but unable to take extensive measures for the protection of the civilian population.

Close review of the evacuation policy shows, however, that it not only suffered from the clash of the different life-styles of the urban and rural populations, but that another social factor was the cause of the social tensions generated. Surveys conducted by the author in Berlin on the evacuation policy, confirmed by surveys in other cities, show that there were significant differences between different areas of the cities. In Berlin, the highest percentage of evacuation, ranging between 45 and 56 per cent, was found in Wilmersdorf, Zehlendorf and Steglitz, traditional

residential areas of the upper middle class and the intelligentsia. In typical workers' quarters of Berlin, however, like Berlin Central, Wedding, Friedrichshain and Prenzlauer Berg, the evacuation ratio fluctuated between 23.5 and 29.0 per cent—i.e. it was almost half as much as in the so-called upper residential areas.²⁴ Moreover, the return-rate to the workers' quarters was extraordinarily high. This is obviously explained by the fact that workers' families could not afford to maintain two separate households in spite of the danger to their lives. Furthermore, there was the 'resolution of large parts of the working class to maintain, without the least regard to the consequences, the coherence of the family as a last resort against the increasingly dissolving social fabric Many of the workers, being apolitical or having been turned apolitical by events, also defended themselves against the regime by repelling intervention into their private lives, an area in which all workers were convinced that they knew best what was good for them.'²⁵

In a similar way this also applied to large parts of the lower middle class of Berlin, mostly small merchants, craftsmen and small businessmen. For them, too, the cost of two households was excessive compared to the generally sparse living they earned. In addition, the small business normally required the help of all family members who could work. Unlike many industrial workers, they could not expect, at least temporarily, special air-raid protection. On the contrary, they were in a very exposed situation because their workshops and shops were mostly located in the centres of the big cities. For them the loss of living quarters in most cases also meant the destruction of their jobs. Reading the damage reports of the municipal authorities after air raids, one can get an idea of how many lower-middle-class people lost the basis of their lives for good in the air raids. It was these segments of urban society which were more harshly and directly affected by the air raids than any other social group.

For the majority of the population of big cities the loss of their property and the destruction of their own homes as a result of the air raids were frequently more severe than the death of close or very close family members. Whole families, also, from the working class felt thrown into a kind of barrack-like proletarian existence by the destruction of their basis of living, which not only called into question their whole previous lives and the expectations for life in the future, but indeed turned them upside down. The destruction of their homes was for millions of

Germans the most direct and dramatic incision into their accustomed way of life; it was the most bitter experience of what war means to any individual, even showing in the memories of the period more than 40 years later.

The area bombardments of the English and American air forces in their attacks on German big cities put an end to a long-running social problem no German government after the turn of the century had solved or even significantly alleviated. In view of decades of serious negligence in the sector of building, the defects multiplied under the consequences of the air raids into an avalanche and made the phrase 'bombed out' a stigma of hopelessness and gloom. As early as 1939 the Reich Labour Ministry had found that, of 17.8 million homes in Germany, one-third urgently needed renovation.²⁶ There was a demand for six million homes, while the net increase in newly built homes in 1939 was only 202,229 units. One must know these conditions to be able to figure out why the massive destruction of homes in the air raids became one of the most serious social problems the German leadership faced in the Second World War. Inherent in it was the danger that it might significantly reduce the burden of war the population could carry. The critical threshold for the Third Reich was therefore reached as early as winter 1943. The lost residential space was given as 180,000 to 200,000 homes at the time – i.e. about 1 per cent of the total – but in the most-affected big cities as much as 3 per cent or more had already been destroyed.²⁷ Within one year, by 1 April 1944, the number of destroyed homes climbed to 1,630,074,²⁸ causing the German Interior Ministry to proclaim a national emergency in this sector. In spite of the lack of exact documentation of the final losses of housing, the post-war figures fluctuate very widely. One can calculate the losses of housing caused by the air raids at a minimum of three million units, which means that almost 20 per cent of all housing in Germany was destroyed.²⁹ This figure is, however, misleading as to the actual extent of destruction in the German big cities.

The attempt to determine the destroyed living space by using the destroyed residential buildings as the basis of calculation results in a magnitude of 650,000 to 700,000 residential buildings.³⁰ In 1939–40, 1.2 to 1.3 million residential buildings were listed in all German cities of more than 100,000 inhabitants. This degree of devastation, then, means that all these big cities lost, on average, 55 to 60 per cent of their previously existing residential buildings as a result of the air raids.

The final toll of war in the housing sector was terrible, and it cut deeply into the lives of the German urban population. By the end of the war, most big cities had not only lost the image built up over centuries but, partially and temporarily, their identity and function. The extent of devastation of the cities by far exceeded any imagination. Someone who wandered through the ruins of the inner-city deserts in 1945 could not but have the occasional impression that German cities had been bombed back into the Stone Age. The extent of this destruction and devastation was one of the most gruesome inheritances and heaviest burdens the war had put on the Germans in facing the task of any democratic reconstruction.

One of the most difficult problems in the analysis of the bombing of Germany is the calculation of losses among the population. Sometimes an almost macabre competition of upping the numbers of losses can be found in the chronicles of big cities, apparently guided by the terrible motto of 'the worse the better'. Such efforts do not serve to find out the truth. Also of influence are unadjusted wartime figures continuously repeated in the literature. Figures for the heaviest raid on Berlin flown by the 8 US Air Force on 3 February 1945 are still given, completely unfoundedly, as 20,000 to 25,000 dead,³¹ although both the investigations of the Berlin police and the register of deaths arrive at a number of about 3,000 killed.³² The same applies to many other cities and communities. The most prominent documentation of this conflict seems to be the dispute over decades on the number of losses in the air raid on Dresden of 12/13 February 1945. Losses have been said to be as high as 400,000, whereas the records prove and allow extrapolation to a number of 35,000 or, at the most, 40,000 killed.³³

Such examples show the tremendous difficulties any historian of the air raids faces when he attempts to make an even half-way correct statement on the losses from the air raids. Exact figures will not be possible because of inadequate records. Figures before late 1942 should be clear.³⁴ The numbers for 1943 and 1944 can be clarified to a large degree; for 1945, however, only approximated reconstruction is possible. The result is, that in 1940 in Germany, 1,150 were killed in air raids, 3,253 in 1941 and 6,825 in 1942. For 1943 one has to assume a number of about 100,000 killed, and for 1944 some 180,000. For 1945 one can take a number of some 115,000 killed. The total number of people killed in air raids on the German Third Reich (to include Austria and annexed areas) would thus be around 406,000: this includes

losses to the Wehrmacht and the police, of prisoners of war and of forced labour.³⁵ The ratio of prisoners of war and forced labour is about 10 per cent. If one calculates the losses of the population within the Germany of 1937 one gets a result of about 360,000 to 370,000 killed.

Sorting these numbers with regard to the represented age-groups and sex (unfortunately, no socially differentiated studies whatsoever are available), one arrives at three main results.³⁶

1. Owing to the composition of the German civilian population during the war, the number of females killed is far greater than their percentage of the total population. This is primarily explained by the recruitment of a large portion of the male population for the Wehrmacht.
2. The victims of the air raids in the age-group between 1 and 15 years are less than their percentage of the total population. This is primarily explained by the evacuation policy and the relocation of complete schools out of the areas of big cities. This does not apply, however, to the death-rate of infants and children between 1 and 5 years of age. This rate largely corresponds to their percentage of the total population.
3. Hardest hit, relatively speaking, by the fatal consequences of the air raids was the population group of males and females of over 60 years. Their percentage of the total population was 12 per cent their ratio among the dead in the air raids amounted to about 24 per cent.

This means that the greatest risk of death among the German civilian population in the air raids was run by women, infants and old people!

Although the title of this essay does not permit me to consider international law in a narrower sense, allow me to point out the problem arising in the context of strategic bombing and in view of the figures and correlations given here. The fact that strategic air raids were contrary to the international law of that time is undisputed, and was also not denied in legal expert opinions sought internally by the Royal Air Force,³⁷ whose leadership, therefore, went to great lengths until late 1945 to conceal the true nature of the bombing campaign, not only from the British public but also from large parts of the RAF and the other services.³⁸

If strategic air raids in the Second World War find any justification in themselves, then it is only within the larger political

framework, which went beyond anything hitherto known, as one was dealing with an opponent who had deliberately started the war, ignoring, as an element of total war, all rules and customs of warfare, in particular in the regions far behind the front, and whose bombing operations flown at the beginning of the war had been bound to evoke, consciously or unconsciously, the impression of totally indiscriminate bombing. This does not really justify the principle; but it delineates the unique, historically irrefutable framework.

As news of the heavy British air raid on Lübeck reached Thomas Mann in far-away California in May 1942, he noted in his diary: 'If one thinks about what is in store for the German cities, justifiably and unavoidably so, one cannot help but feel a mild horror.'³⁹ A few days before, he had explained to his German radio audience:

In the latest British raid on Hitler's Germany the old city of Lübeck had to suffer. This concerns me, it is my home town. The attacks were directed against the port, plants of war industry, but there were fires in the city, and I hate to think that St Mary's church, the wonderful Renaissance city hall or the house of the Mariners' Association have been damaged. But I think of Coventry and I have no objection against the theory which says one has to pay dearly for everything.⁴⁰

But it would be too simple to attribute the responsibility for the devastating, equalising effect of bombings merely to the dynamic violence of the modern power of destruction. Objectively, there is such a trend, indeed; but how it is used in practice is a matter of decision for the actors. The argument still frequently read today that, in view of the technological level of the weaponry, the military leaders of Great Britain and the United States did not have any alternative to conducting the aerial war in the forms witnessed in the Second World War, overlooks the existing latitude of decisions, which was also discussed during the war in a lively and controversial way within the military leadership of the United States and Great Britain, as the files available today prove.⁴¹

The bombing strategy could serve to integrate itself as one link in the comprehensive efforts of the powers of the anti-Hitler coalition against Hitler's Germany, as an element of the anti-Fascist war which primarily rested on the armed forces of the Soviet Union; or it could be considered as an end in itself, as a

primary means to decide the war alone and by its own effect. It could opt either for deliberate destruction of the military and economic pillars of Fascist power, or it could be designed to bring extensive, indiscriminate devastation to what constituted the Fascist hinterland in the broadest sense.

Such a decision was never really made in the bombing strategy of the Western Allies in the Second World War. So the British and, after the bombing of Lübeck on 28 March 1942, also the American bombing operations, despite all the differences from the British doctrine, alternated erratically between the two extremes. From the spring of 1944 on, bombing had a significant, war-shortening effect on the German oil industry, on the traffic systems of the regime and on a number of armament-industry centres; but on the whole it had its greatest effect on the big cities of Germany, of which hardly any came out of the war without having sustained severe damage.

In the last months of the war, the devastation was felt particularly where the demands and the course of the war were separated by an ever-widening gap. The impending end of the Fascist war of expansion, brought about by the armies of the anti-Hitler coalition, did not, however, mean the end of the air raids. The smoke and flames seen over Dresden and Dessau, Pforzheim and Hildesheim, Nordhausen and Potsdam were horrible signs which continued to reflect beyond the immediate cause far into the post-war era, because they symbolised the beginning of new horrors rather than the final end of Fascist barbarity.

The bombing operations of the years 1939 to 1945 have not lost the effect of a historic warning even in the present. Many peoples of Europe and Asia suffered as a result of them. But this applies in particular to the German population, which was hardest hit by their effects; and in times of mounting political tension it developed a special sensitivity for the notion that, under the threat of nuclear holocaust, the air raids of the Second World War were no more than a glimpse at what future total destruction would be. No other people in Europe must, recalling those historical experiences, be more interested that never again should a war start on German soil.

Notes

1. International literature on this subject is so exhaustive that to list even the most important titles would go beyond the scope of any bibliography. Of lasting influence and an indispensable element of any research are, first, the 208 studies of the United States Strategic Bombing Survey on the results of the strategic air raids in Europe, published shortly after the end of the Second World War, some of them re-edited and published by David Mac Isaac in 1976, and, second, the studies of the British Bombing Survey Unit, available at the Public Record Office London, Air Ministry. Still important are the two volumes, first published in 1949 and 1951, respectively, by Wesley Frank Craven and James Lea Cate, *The Army Air Forces in World War II*, Vol. II, 'Europe: Torch to Pointblank, August 1942 to December 1943', Chicago, 1949, and Vol. III, 'Europe: Argument to VE Day. January 1944 to May 1945' Chicago, 1951, and also the four volumes by Charles Webster and Noble Frankland, *The Strategic Air Offensive against Germany 1939-1945*, London, 1961, despite their limitations and constraints, which are becoming increasingly apparent when studying the files in London and Washington. A survey of the older literature up to 1960 is given by Karl Köhler, 'Bibliographie zur Luftkriegsgeschichte', *Schriften der Bibliothek für Zeitgeschichte*, 5, Frankfurt, 1966, pp. 167 ff; more recent English and American literature is compiled in Myron J. Smith, *Air War Bibliography, 1939-1945, English-language sources*, Vols 1-5, Manhattan, Kansas, 1977-82, and R. J. Overy, *The Air War 1939-1945*, 2nd edn, New York, 1982, pp. 225 f, 251.

Since the 1980s renewed interest has been witnessed in questions of the strategic air war, especially in the moral dimension, often in conjunction with studies of city and local history, particularly in Great Britain with the publications of Max Hastings (*Bomber Command*, London, 1979), Martin Middlebrook (*The Battle of Hamburg*, London, 1980; *The Peenemünde Raid*, London, 1982; *The Bomber Command War Diaries*, Harmondsworth-New York, 1985) and Norman Longmate (*The Bombers. The RAF Offensive against Germany, 1939-1945*, London, 1983) and in the USA with Ronald Schaffer's *Wings of Judgment. American Bombing in World War II*, New York-Oxford 1983 and the same author's 'American Military Ethics in World War II: The Bombing of German Civilians', *Journal of American History*, 47, Sept. 1980, pp. 318-34.

The same applies to many discussions dealing with specific cities in the FRG and the GDR in recent years, such as those by Götz Bergander and Walter Weidauer on Dresden, Heinrich Dunkhase on Würzburg, Alois Stadtmüller on the Main river and Spessart area, Hermann Meyer-Hartmann on Hildesheim, Friedhelm Golücke on Schweinfurt, Rudi Hartwig and Manfred Wille on Magdeburg, Helmuth Schratz on Koblenz, Olaf Groehler and Laurenz Demps on Berlin, Olaf Groehler on Dessau, Heinz Petzold on Cottbus, Manfred Schröter on Nordhausen and Werner Hartmann on Halberstadt. For the vast regional literature of recent years, see Olaf Groehler, *Bombenkrieg gegen Deutschland (1940-1945)*, Berlin, 1990.

2. This is impressively reflected in the situation reports of the SS Intelligence from the summer of 1943. They show which of the formations of the 8 US Air Force flying against Schweinfurt in August 1943 were initially identified as German bombers en route for an operation against England. (*Bayern in der*

- NS-Zeit. *Soziale Lage und politisches Verhalten der Bevölkerung im Spiegel vertraulicher Berichte*, ed. Martin Broszat, Elke Fröhlich and Falk Wiesemann, Munich-Vienna, 1977, p. 646 f.).
3. Especially typical for such reactions in the FRG are the publications of Hans Rumpf, *Das war der Bombenkrieg*, Oldenburg, 1961, Eberhard Spetzler, *Luftkrieg und Menschlichkeit*, Göttingen-Berlin-Frankfurt, 1956, as well as Franz Kurowski, *Der Luftkrieg über Deutschland*, Munich, 1979. Kurowski even dared to maintain that the conclusion to be drawn from the air raids was 'how one form of barbarity had been "exorcised" by another' (p. 317).
4. In the GDR, initially the tendency was to reduce the phenomenon of the air raids to a matter of its effectiveness; see Walter Bartel, *Deutschland in der Zeit der faschistischen Diktatur 1933-1945*, East Berlin, 1956, p. 249. Gerhard Förster, Heinz Helmert and Helmut Schnitter, *Der zweite Weltkrieg*, Leipzig, 1962, p. 203 f.
5. See e.g. the intervention of Horst Boog on Klaus A. Maier's contribution 'Der Aufbau der Luftwaffe und ihre strategisch-operative Konzeption, insbesondere gegenüber den Westmächten', in *Deutschland und Frankreich 1936-1939*, 15. Deutsch-Französisches Historikerkolloquium des Deutschen Instituts Paris, Munich-Zürich, 1981, p. 678, and Horst Boog, *Die deutsche Luftwaffenführung 1935-1945, Führungsprobleme, Spitzengliederung, Generalstabsausbildung*, Stuttgart, 1982, p. 11, note 3.
6. See e.g. W. Berthold, *Der Sieg der vor die Hunde ging. Der Luftkrieg 1939-1945*, Bayreuth, 1981.
7. On such aspects of the German air war concept, see Klaus A. Maier, *Guernica 26 April 1937. Die deutsche Intervention in Spanien und der Fall 'Guernica'*, Freiburg, 1975; idem, 'Der Aufbau der Luftwaffe und ihre strategisch-operative Konzeption, insbesondere gegenüber den Westmächten', in *Deutschland und Frankreich 1936-1939*, esp. pp. 295-8; idem, 'Die Luftschlacht um England', in *Militärgeschichtliches Forschungsamt (ed), Das Deutsche Reich und der Zweite Weltkrieg*, Vol. II, Stuttgart, 1979, p. 386.
8. For the Polish view on this, see Adam Kurowski, *Lotnictwo Polskie w 1939 roku*, Warsaw, 1962; Andrzej Rzepniewski, *Wojna powietrzna w Europie 1939-1945*, Warsaw, 1982, pp. 33 ff.
9. Bundesarchiv/Militärarchiv Freiburg, RL 2 II/51.
10. Ibid.
11. Hans Brunswick, *Feuersturm über Hamburg*, Stuttgart, 1978, p. 24.
12. Zentrales Staatsarchiv (ZStA) Potsdam, Nr. 13 516.
13. Brunswick, *Feuersturm*, p. 24.
14. *American Journal of International Law*, London, 1945, Vol. XXIX, p. 689.
15. ZStA Potsdam, Statistisches Reichsamt, Nr. 3363, p. 51.
16. Erich Hampe, *Der zivile Luftschutz im Zweiten Weltkrieg*, Frankfurt am Main, 1963, p. 175.
17. Calculation based on statistics of the Statistisches Reichsamt, in Bundesarchiv Koblenz, R 24/44.
18. ZStA Potsdam, Reichsminister für Rüstung und Kriegsproduktion, Nr. 47, pp. 33 ff.
19. ZStA Potsdam, Rechnungshof des Deutschen Reiches, Nr. 680, p. 2.
20. ZStA Potsdam, Reichsministerium für Rüstung und Kriegsproduktion, Nr. 88, p. 1.

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21. ZStA Potsdam, Statistisches Reichsamt, Nr. 3363, p. 53.
22. BA Koblenz, R 36/2697.
23. See Heinz Boberach (ed.), *Meldungen aus dem Reich, 1938-1945 Die geheimen Lageberichte des Sicherheitsdienstes der SS*, Herrsching 1984-5, Vol. 14, pp. 5643 ff., Vol. 15, pp. 6025 ff.
24. Calculation based on documents of the Bundesarchiv Koblenz, R 26/2651.
25. W. F. Werner, 'Bleib übrig', *Deutsche Arbeiter in der national-sozialistischen Kriegswirtschaft*, Düsseldorf, 1983, p. 273 f.
26. 'Die Wohnungsfrage. Ein Versuch zur Klärung der sozial und wirtschafts-politischen Problematik des Wohnungsbaues', in *Jahrbuch 1939*, Arbeitswis-senschaftliches Institut der Deutschen Arbeitsfront, Vol. 1, Berlin, pp. 352 ff.
27. ZStA Potsdam, Nr. 19 384.
28. Archiwum Główniej Komisji Badania Zbrodni Hitlerowskich w Polce, War-saw, GK 1151/27x.
29. See Olaf Groehler, *Bombenkrieg gegen Deutschland*, Berlin, 1990, chapter on 'Die Verwaltung des Mangels: Wohnraumnott'.
30. Extrapolated from documents at the Bundesarchiv Koblenz, R 18/917.
31. Craven and Cate, *The Army Air Forces in World War II*, 'Europe: Argument to VE day', p. 726. Kurowski, *Lotnictwo*, p. 310, gives 22,000 killed, Werner Girbig . . . *im Anflug auf die Reichshauptstadt*, 2nd edn, Stuttgart, 1971, p. 200, says 20,000 to 25,000 dead, and Schaffer, *Wings of Judgment*, p. 97, 25,000 victims.
32. Olaf Groehler, *Berlin im Bombenvisier*, East Berlin, 1982, p. 49.
33. Cf. Walter Weidauer, *Inferno Dresden*, 4th edn, East Berlin, 1983, pp. 110 ff. and Götz Bergander, *Dresden im Luftkrieg*, Cologne-Vienna, 1977, pp. 157 ff.
34. Bundesarchiv/Militärarchiv Freiburg, RL 5/649.
35. For details with bibliographical sources see Groehler, *Bombenkrieg*, the chapter 'Menschenverluste im Bombenkrieg'.
36. These surveys are based on the results of documentation of city histories, for example, of Berlin, Dessau, Rostock, Kiel and cities of the Ruhr area.
37. For this, see the discussion in the Air Ministry in autumn 1942 in regard to the demand of the Czechoslovak exile government to retaliate for Lidice by indiscriminate bombing of Germany, and the document 'Bombardment Policy in enemy occupied countries', promulgated in October 1942, Public Record Office London, AIR 9/187. See also the protests of early 1943 by the Dutch and French exile governments against the air raids of the 8th US Air Force, in PRO London, AIR 2/8694, and Schaffer, *Wings of Judgment*, p. 38 f.
38. See, for example, the debates in the House of Commons of 24 November 1942, 11 March 1943, 1 December 1953 and 6 March 1945, as well as the 9 February 1944 debate in the House of Lords (*Parliamentary Debates, House of Commons*, vol. 385, London 1943, cols. 685 f., vol. 387, London 1943, cols. 929 f., vol. 395, London 1949, cols. 337 f., vol. 408, London 1945, cols. 1898 f., *Parliamentary Debates, House of Lords*, vol. 130, London 1944, col. 739) and PRO London, AIR 20/4207.
39. Thomas Mann, *Briefe 1937-1947*, ed. Erika Mann, Berlin-Weimar 1965, p. 270.
40. Thomas Mann, *Zeit und Werk. Tagebücher, Reden und Schriften zum Zeitgeschehen*, East Berlin, 1956, p. 655.
41. These conflicts culminated, most probably, in spring 1942 and winter 1943/44. See PRO London, AIR 40/1814, AIR 14/696 and AIR 2/4477.

17

Strategic Air War and International Law

Manfred Messerschmidt

Strategic air war in the form of area bombing, which was practised during the Second World War in Europe and against Japan, has been called terror warfare.

The question whether it was in accordance with international law remains a matter of dispute, although the answer is not difficult to find. There was no specific agreement banning air warfare. It was well known that the attempt to uphold the ban on dropping explosives from aircraft contained in the Declaration of the Hague of 29 July 1899 failed at the Conference of the Hague in 1907. France, Germany and Russia would not agree to its extension. No such agreement was made between the wars. The attempts first made at the Washington Conference of 1921-2 to reach an agreement only resulted in the proposals made in 1923 by the Hague Commission of Jurists.¹ Their agreement stipulated that: 'bombardment by aircraft for the purpose of . . . terrorizing the civilian population is forbidden'. Except for Japan and the United States, no major power was interested in converting the experts' proposal into a binding agreement. Anglo-German talks in 1935 (Hitler-Eden-Simon) also failed to produce tangible results. When the war began there were no specific rules governing air warfare, just as at the outbreak of the First World War. The military and the air-war planners hardly even discussed the conflicting relationship between air warfare and international law, let alone drawing any logical conclusions about it.

This chapter will deal neither with borderline cases nor with air raids on strategic targets in inhabited areas. The discussion will focus exclusively on bombing raids against the civilian population with the aim of demoralising them and thus bringing about a quick victory. Although this argument is usually raised

in connection with other elements of strategy, it cannot be denied that this strategy against the civilian population, against women, children and the elderly, and of course against the working population as well, had been worked out in theory and then implemented. Military advocates of this strategy rarely allowed themselves to be confused by legal issues.

What pre-existent rules and conventions applied to aerial warfare?

Were there really no legal constraints on air warfare? Was there reason to conclude that the rules of land warfare could not be applied to air war because no agreement on air war had been concluded at the Hague? The discussion revolved around the following international rules on land warfare of the Hague Convention:

- *Art. 23 e* on:
the employment of arms, projectiles or material calculated to cause unnecessary suffering;
- *Art. 23 g* on:
the destruction of enemy property unless such destruction be imperatively demanded by the necessities of war;
- *Art. 25* on:
the banning of the attack or bombardment, by whatever means, of towns, villages, dwellings or buildings which are undefended; and
- *Art. 27* on:
rules of protection during sieges or bombardments, especially the rule to 'take all necessary steps to spare as far as possible buildings dedicated to religion, art, science, or charitable purposes, historic monuments, hospitals, and places where the sick and wounded are collected'.
- *Convention respecting the laws and customs of war on land* (preamble to the Hague Convention) of 18 October 1907 (Martens clause).
Until a more complete code of the laws of war has been issued, the High Contracting Parties deem it expedient to declare that, in cases not included in the Regulations adopted by them, the inhabitants and the belligerents remain under the protection and the rule of the principles of the law of nations, as they result from the usages established among civilised peoples,

from the laws of humanity and the dictates of the public conscience.

Also of importance were the agreement on bombardment by naval forces in time of war, dated 18 October 1907:

-Art. 1: Naval forces are forbidden to bombard ports, towns, villages, habitations and buildings which are not defended.

and the Hague 'Rules of Air Warfare' (of the Commission of Jurists):

-Art. 23

Aerial bombardment for the purpose of terrorising the civilian population or destroying or damaging private property not of a military character, or of injuring non-combatants is prohibited.

Some said that the Hague rules of land warfare should not be applied to air warfare. This was a purely formal deduction from the request in the final act of the Hague Convention for the application of the rules on land warfare to sea warfare. On the other hand, an interpretation based on the purpose of the agreements takes the opposite point of view - a view primarily supported by the preamble to the Convention on Land Warfare, in particular by the Martens Clause, which specifically takes the development of new weapons into account. Furthermore, the reference to the 'laws of humanity' and the 'dictates of public conscience' is essential. It confirms that all acts of warfare shall be subject to these principles.

It was these considerations that inspired Articles 23e and 25 of the Hague Rules of Air Warfare. In the light of the strategic bombing war against the civilian population, in my opinion, the 'legal justification' of achieving the goals of war is no excuse for the revocation of these principles. Besides, the course of the Second World War showed that the destruction of residential areas did not prove decisive, but rather that the concentration of air raids on targets vital to the economy would have been more sure to paralyse the enemy. It is obvious that the minority view that Art. 25 of the Hague Rules of Air Warfare merely envisaged places which were right in the actual battle zone has been overtaken by history, and even more so by the development of armaments.² Moreover, Art. 25 of the Hague Rules of Air

Warfare is to be considered along with Arts. 1 and 2 of the Agreement on the bombardment by naval forces in the time of war, dated 18 October 1907. This refers to the military importance of the objective as well as to the ratio of the desired success to the number of civilian casualties. As it was intended that the terror war should provide many casualties, even its calculations were against the principles of the Hague Rules of Air Warfare and the above-mentioned agreement.

While there are tendential differences in the Anglo-Saxon and the continental European views of international law, there is no evidence to suggest continuing differences of opinion on the ban on bomb warfare against non-combatants. In fact, before the Second World War or shortly after it began, some air powers accepted the rules of the Hague Convention as being applicable to air warfare, although they were not always compatible with strategic concepts.

For instance, the manual approved on 1 October 1939 by the Chief of the German Armed Forces High Command, entitled 'International Law on Warfare. A collection of international agreements of relevance to the higher command',³ lists both Art. 25 of the Hague Convention on Land Warfare and the 'Hague Rules of Air Warfare' of 1923 under 'Provisions of particular importance for the air war', with the comment that they were not legally binding but 'in practice, important as an indicator for the development of a future code of air war rules'.⁴

In 1940, the British government hesitated to commence strategic bombing of Germany for various reasons which will be discussed below. But one significant aspect was the notion that they did not wish to be regarded by the public as the initiator of this kind of warfare. The Chief of the Imperial General Staff had already argued against the Chief of the Air Staff, Trenchard, in May 1928: 'It seems . . . clear that it is entirely to our advantage to keep within the accepted codes for the conduct of war as regards the employment of our air forces.'⁵ He specifically referred to the 'Hague Rules of Air Warfare'. Since the United States had had the greatest influence on the work of the commission, it can quite rightly be said that the most important air powers in the European theatre of war in the Second World War assumed that there was a binding code for the conduct of the air war.

What were the reasons for ignoring this code? What made terror air war possible?

We may conclude from the most important works on this subject that a combination of air-war theory, air armament and the strategic situation, particularly in Great Britain, was the main reason.

Although on the German side this combination was incomplete, there had been theories on terror air war. They extended from the period of the Weimar Republic into the war, and there had been at least draft air-armament proposals.

Especially noteworthy was the Knauss memorandum entitled 'The German Air Fleet' of May 1933,⁶ which recommended a risk-terror air force and was supported by Milch. Using ideological catchphrases Knauss sought support at 'the highest level'. 'The weaker the national fervour of a people, the more materialistic the masses of people living in large cities become and the more they are divided by social and political conflicts, the faster will terror bombing of enemy capitals and industrial areas bring about moral collapse.' Terror warfare thus seemed to be an effective weapon against Western democracies, but it was not put into practice. The Luftwaffe leadership intended to use the air force, which had in fact been built up, and its medium-range bombers not only to provide tactical support for the army and the navy, but also to engage in 'operational' air warfare against the enemy 'sources of strength' and break down his resistance. However, this statement, included in the manual entitled 'Air War Operations'⁷ by Major General Wever, the Chief of the Luftkommandoamt, was based on the premise that operations against enemy armed forces would take precedence. However, strategic-operational air war proved so fascinating that its possibilities were the subject of further reflection. Thus in late October 1936 the Chief of the Operations Division of the Luftkommandoamt (Air Force General Staff), Major Deichmann, in his paper on 'Principles for the Operational Conduct of the Air War'⁸ as part of the training in operational decision-making in war games, called for a way to be found to 'making decisions against the morale of a people'.

Once England was considered an enemy, her air bases in the east of England and London with its port and armaments factories, as well as the ports on the English Channel, were targeted. The Luftwaffe Staff assumed that they could get their hands on Holland and Belgium and use them as a base for air

operations against Great Britain. However, a map exercise in May 1939 revealed that essential prerequisites were still unfulfilled – for example, and not least, there were no suitable bombers. Instead, much attention had been devoted to air defence. In the summer of 1939, air-defence artillery personnel accounted for about one-third of the total strength of the Luftwaffe. While this proves that the Luftwaffe was incapable of waging a strategic air war because of shortcomings in crucial areas, there is no reason to believe that the decision stems from a willingness to uphold international law.

On the contrary, the Condor Legion had already tested terror air raids in the Spanish Civil War, and the results were presented in a report. During the critique of the May 1939 map exercise, General Felmy, on the question of terror air raids against England, stated that every bomb would have to be an instrument of terror. As part of the 'struggle for existence' of the German people, the battle against the industrial centres of the Midlands was to be conducted as a 'pure terror attack'. However, until 1942, Felmy maintained that German readiness for such an attack could not be taken for granted.⁹

The Chief of the Armed Forces Staff, Jodl, who was more optimistic about this after the half-won victory in the West, felt that the final victory was within reach. In his memorandum of 30 June 1940 on the continuation of the war against England 'terror attacks' against populated areas emerged as a powerful tool.¹⁰ It sought to combine such attacks with selective attacks on the Royal Air Force, the aircraft industry and the supply lines. The interspersed terror raids were to be part of the overall strategy, and made to look like 'retaliation'. Heavy air raids, for example, on Liverpool, were also recommended by Raeder in July 1940 to 'let the whole population feel the effects'.¹¹ It was clear to the German leadership that it would take striking successes in the air war to defeat Great Britain and, especially, that any invasion would be impossible without air superiority.

Hitler's directive dated 1 April 1940 called for the intensification of the air war, but specified strategic military targets – the air-armament industry, the RAF, ports, food stores – targets, however, which were bound to affect the civilian population. Goering had also described the mission in such terms to commanders. Only for the 'final battle' did he demand 'heavy attacks to break down the resistance of the whole country'. The 1st German Air Corps added to his proposals of 1 August: 'Irrespective of these tasks, relentless terror raids on large cities

may also be considered retaliatory.¹² Such proposals were based on the assumption of German superiority, and could not be implemented without Hitler. But on 1 August 1940, he had reserved himself the right to order terror raids.

The struggle for air superiority began with great optimism on 13 August, and ended in failure. This was the first decisive blow against the strategy of the German leadership, which revealed their mistaken air-armament policy. It has been said that from then on the Luftwaffe 'gave in to the temptation' to attack London, and not even the OKW directive of 24 August stipulating that air raids on London were to be decided by Hitler could stop them. On the same day some 100 combat aircraft carried out an attack on London. On 25/26 August the Royal Air Force launched their attacks on Berlin, and in his speech of 4 September Hitler called for retaliatory attacks on London, which were to commence on 7 September. Although the first attack, directed mainly at the docks, claimed many lives among the civilian population, 306 in the city and 142 in the suburbs, Hitler's directive of 5 September 1940 ordering 'nuisance attacks on the population and the air defences of major English cities, including London, by day and night' did not bring about a transition from a general air war to a terror air war alone. However, it basically provided the orders for it. On the other hand, the choice of London proved to be an advantage for the English air defences.

Great Britain, building on decades of effective air-war strategy, was able to co-ordinate the above elements much more systematically, so that the doctrines of the Trenchard school finally gained acceptance after 1941-2:

- A strategic bomber fleet had been built up.
- The doctrine of indiscriminate bombing had been developed.
- The strategic-operational situation evolved once it had become clear that the possibilities of precision bombing were limited.

As early as April 1940 the Air Staff acted accordingly by directing Bomber Command to restrict sorties of heavy bombers to night-time.

At that time, the Air Staff also believed that the Germans had hitherto only attacked military targets. On 10 May 1940, after the German attack in the West, the War Cabinet decided to attack the Ruhr. During the month of May there was increasing

pressure to bomb civilian targets as well. After the defeat of France the strategic bomber was for years the only effective weapon against Germany.

Alongside the operational consequences of such attacks, which forced the Germans to provide defence equipment and personnel, there was increasing speculation as to their effect on morale.

The various developments which occurred from July to October 1940 are reflected in Churchill's decisions and recommendations made by Portal, Chief of Bomber Command, who became Chief of the Air Staff at the end of October 1940. In September 1940 Portal recommended that bombing should be commenced with a view to breaking the will of the German people 'to continue the war', and in October a number of German cities were put on the target list. Area bombings commenced in December 1940 with 'Operation Abigail'. The English high command did not regard these attacks as reprisals.

It was indeed a long-term strategy aimed at breaking morale and anticipating a number of civilian casualties which bore no relation to the casualties inflicted by German air operations. British plans focused on the period from 1944 onwards. One of the most important testimonies to this is the comment of the Chief of the Air Staff to the Chiefs of Staff 'on an Estimate of the Effects of an Anglo-American Bomber Offensive Against Germany' of 3 November 1942.¹³

Whereas the Luftwaffe had dropped 55,000 tonnes of bombs on England between June 1940 and June 1941, including 36,000 tonnes on industrial areas, killing 42,000 civilians, seriously injuring 45,000, and destroying 350,000 houses, the Air Staff had the following plans: by the end of 1944 the bomber fleet was to be increased to 6,000 aircraft, and the monthly bomb-rate was to be increased from 25,000 tonnes in June 1943 to 90,000 tonnes in August 1944. This was to destroy some 8 million houses and damage some 60 million. An estimated 900,000 people would be killed and one million seriously injured. As far as the bomb tonnage is concerned the actual figures were even higher.

The Americans planned similar, and perhaps even more perfect, bombing operations against the practically defenceless Japanese cities, culminating in the dropping of the atomic bombs on Hiroshima and Nagasaki. This kind of air warfare had nothing whatsoever to do with retaliation.

Opinions expressed in the Anglo-Saxon countries suggested that this kind of warfare should have been permitted on grounds of 'military necessity'. Truman summed the situation

up thus: 'We sent an ultimatum to Japan. It was rejected. I ordered atomic bombs dropped on the two cities named. Dropping the bombs ended the war, saved lives and gave the free nations a chance to face the facts.'¹⁴

Neither the dropping of the atomic bombs nor the area bombardment of cities were a military necessity as defined in the rules of international law; Dresden and the bombing of Tokyo on 9 and 10 March 1945, which claimed over 80,000 lives and razed 270,000 buildings to the ground, were particularly serious examples. The Americans described the results of this 'wise choice and efficient performance of the tactics involved' as 'the most effective mission ever accomplished in terms of area totally damaged per bomb tonnage dropped'.¹⁵

Bearing in mind the pseudo-scientific motives of strategic bombing, with its strategic dogmas and tactical procedures, it soon becomes clear why there was no room left for any consideration of international law. From now on, the theories could be borne out by experiments. The project had entered the test phase: success had become mandatory. The bombings of Hamburg and Dresden were undoubtedly the most perfect experiments in the war against Germany. The largest single bombing hitherto had been carried out on Dortmund on 23 May 1943 by 826 bombers. Hamburg's 'battle' began on 24 July 1943 (night attack, 791 bombers), and continued on 25 and 26 July with daylight attacks by the 8th (US) Air Force with 235 bombers; on 27 July (night attack, 787 bombers), 29 July (night attack, 777 bombers) and 2 August (night attack, 740 bombers). This last attack was intended to 'set the seal upon the already frightful destruction wrought in the first three attacks'.¹⁶ On the basis of aerial photographs, the Air Ministry and Bomber Command deemed this attack the climax of the great catastrophe of Hamburg. Harris compared Hamburg with Coventry, where only 100 out of 1922 acres had been destroyed, while in Hamburg the figure was 6,200 out of 8,382. Allied estimates put the casualties at 42,600 dead and 37,000 injured. On 3 November 1943, in a memorandum to Churchill, Harris outlined the results of strategic bombing raids.¹⁷

1 *virtually destroyed:*

Hamburg, Cologne, Essen, Dortmund, Düsseldorf, Hanover, Mannheim, Bochum, Mülheim, Köln-Deutz, Barmen, Elberfeld, Mönchen-Gladbach/Rheydt, Krefeld, Aachen, Rostock, Remscheid, Kassel, Emden.

2 seriously damaged:

Frankfurt, Stuttgart, Duisburg, Bremen, Hagen, Munich, Nuremberg, Stettin, Kiel, Karlsruhe, Mainz, Wilhelmshaven, Lübeck, Saarbrücken, Osnabrück, Rüsselsheim, Berlin, Oberhausen.

3 damaged:

Brunswick, Darmstadt, Leverkusen, Flensburg, Jena, Augsburg, Leipzig, Friedrichshafen, Wismar.

In the final phase of war, after mid-1944, the bomber was no longer the only indispensable weapon in the hands of the Allies. Improved bomb-sights now also allowed precision attacks. The continuation of area bombing aimed at demoralising the population illustrates that the air-armament structure, and the strategic schools of thought developed in Bomber Command since the First World War, had gained virtually illimitable importance within the overall strategy and policy, and acted virtually independently. In addition the technological effort as such reinforced this development.

Hence, the following equation: the war must be conducted in this way to prevent bloodshed – and this seems to be the only way possible – therefore, it is justified. However, the equation is wrong. It does not justify such actions as valid military necessities as defined by international law. The end-result of this strategy is the large-scale killing of non-combatants to spare soldiers. None of the above-mentioned rules and provisions of international law permits such action.

Strategic bombing of the civilian population was for years a blatant violation of international law, carried out with the consent of both the political and the military leadership, and on the authority of Churchill, Roosevelt and Truman. It is no secret that Roosevelt recommended the bombing of smaller German cities as early as June 1941 to break down the resistance of the Germans.

From the point of view of international law, the attitude of America, which remained out of reach of the bombers, is to be judged especially negative. On the whole, however, it must be said that strategic air war against the population could not be legally justified or excused.

Brought to its logical conclusion, it left the enemy with a choice between annihilation or capitulation. This alternative is not an objective as defined by international law. The absolute

intensification of injustice cannot lead to a legally acceptable result. One can only agree with Tony Carty, who, with reference to Paskins and Dockrill,¹⁸ states:¹⁹ 'The language of strategic bombing never becomes any more precise than the expectation that unacceptable levels of injury are bound to make the enemy prefer surrender, given the assumption that anything is preferable to extermination.'

Notes

1. L. H. Brune, 'An Effort to Regulate Aerial Bombing: The Hague Commission of Jurists, 1922-23', *Aerospace Historian*, 29, 1982, pp. 183-5; the text of the proposals can be found in *New York Times*, 10, 17 and 23 June 1923 (Parts 1 and 2), 24 June 1923 (Part II 1 and 5); extracts in: *Foreign Relations of the United States* (FRUS), Washington, 1923, I, pp. 67-87. Cf. also Manfred Messerschmidt, 'Kriegstechnologie und humanitäres Völkerrecht in der Zeit der Weltkriege', *Militärgeschichtliche Mitteilungen*, 41, 1987, pp. 63-110 p. 76 f).
2. On the problems surrounding Art. 25 of the Hague Rules on Air Warfare see also E. Spetzler, *Luftkrieg und Menschlichkeit. Die völkerrechtliche Stellung der Zivilpersonen im Luftkrieg*, Göttingen, etc., 1956, p. 35; and also A. Euler, *Die Atomwaffe im Luftkriegsrecht*, Cologne, 1960, p. 87.
3. H. Dv. No. 231 II, M. Dv. No. 435 II, L.Dv. No. 64 II.
4. H. Dv. No. 231 II, S. 99.
5. C. Webster and N. Frankland, *The Strategic Air Offensive against Germany 1939-1945*, Vol. 4: *Annexes and Appendices*, London, 1961, pp. 76-81.
6. B. Heimann and J. Schunke, 'Eine geheime Denkschrift zur Luftkriegskonzeption Hitler-Deutschlands vom Mai 1933', *Zeitschrift für Militärgeschichte*, 3, 1964, pp. 72-86.
7. L. Dv. 16 Luftkriegsführung (L.F.) 1936; reprinted March 1940.
8. K.-H. Völker, *Dokumente und Dokumentarfotos zur Geschichte der deutschen Luftwaffe. Aus den Geheimakten des Reichswehrministeriums 1933-1939 ...*, Stuttgart, 1968, No. 198.
9. K. A. Maier, 'Totaler Krieg und operativer Luftkrieg', in *Militärgeschichtliches Forschungsamt* (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, Stuttgart, 1979, p. 64 f.
10. K. Klee, *Dokumente zum Unternehmen 'Seelöwe'. Die geplante deutsche Landung in England 1940*, Göttingen, 1958, p. 298 f.
11. Cf. G. Wagner (ed.), *Lagevorträge des Oberbefehlshabers der Kriegsmarine vor Hitler 1939-1945*, Munich, 1972, p. 109.
12. *Militärgeschichtliches Forschungsamt*, Sammlung von Rohden, Film No. 2.
13. C. Webster and N. Frankland, *The Strategic Air Offensive against Germany 1939-1945*, Vol. 4: *Annexes and Appendices*, London, 1962, App. 20, pp. 258-64.

14. Cf. W. F. Craven and J. L. Cate, *The Army Air Forces in World War II, Vol. 5: Matterhorn to Nagasaki June 1944 to August 1945*, Chicago, 1953, p. 712 f.
15. *The United States Strategic Bombing Survey*, ed. D. MacIsaac, 10 vols., New York, 1976, Vol. X, p. 116.
16. Webster and Frankland, *Strategic Air offensive*, Vol 2, p. 154.
17. *Ibid.*, p. 47.
18. B. Paskins and M. Dockrill, *Ethics of War*, London, 1979, p. 6.
19. T. Carty, 'The Origins of the Doctrine of Deterrence and the Legal Status of Nuclear Weapons', in H. Davis (ed.), *Ethics and Defence, Power and Responsibility in the Nuclear Age*, London-New York, 1987, pp. 104-132 (here p. 116).

18

Air War and the Laws of War

W. Hays Parks

For many it must seem incongruous to speak of 'law' in light of the degree of destruction wrought during the Second World War. Indeed, 'law of war' appears a contradiction in terms when one considers the number of civilian dead,¹ recalls British Prime Minister Winston Churchill walking amidst the rubble of Coventry,² or views the photographs of the massive cathedral of Cologne surrounded by an utterly devastated city.³ Having directed much of one nation's strategic air offensive and daily witnessed its deadly effects, it is not surprising that Marshal of the Royal Air Force Sir Arthur Harris concluded after the war that 'International law can always be argued *pro* and *con*, but in this matter of the use of aircraft in war there is, it so happens, no international law at all.'⁴ After more than a decade of examination of this issue, I have concluded that the wartime commander of RAF Bomber Command regrettably was more right in his comment than he was wrong. Rather than attribute this to lawlessness on the part of any or all parties to the conflict, I regard it more as recognition of the limits of the law in total war – as well as acknowledgement of the failure of nations to come to agreement on practical limitations on the employment of arms in the four decades preceding that conflict, despite reasonable warning regarding the potential level of destruction.

There has been criticism of the bombing campaigns of the Second World War, and particularly the allied strategic air offensive and the United States' bombing campaign against Japan (including the use of atomic bombs against Hiroshima and Nagasaki). This is an inevitable outcome of post-war debate in democracies, and I do not view my role in this symposium as a 'trier of the fact', to render judgement on the tactical, political, legal, or moral issues involved in that debate. In fact, I have depended upon the works of historians present at this sym-

posium to place my thoughts in perspective. And I have assumed that the questions I should pose – and answer, to the extent possible – are the following:

- (1) What was the law of war with regard to aerial bombardment (hereinafter 'bombing', for brevity's sake) prior to, and during, the Second World War?
- (2) To what extent did national leaders and/or air forces observe it?

In answering these questions, I have endeavoured to follow the judgement of the court in one of the post-war war crimes trials. In the case of *United States v. List et al.*,⁵ Generaloberst Lothar Rendulic was charged with carrying out a 'scorched earth' policy in the Norwegian province of Finnmark. General Rendulic acknowledged his actions, but argued that they were taken in the belief that Russian forces were in hot pursuit of his retreating units. The court, in acquitting General Rendulic of the charge, concluded:⁶

There is evidence . . . that there was no military necessity for this destruction and devastation. An examination of the facts in retrospect can well sustain this conclusion. But we are obliged to judge the situation as it appeared to the defendant at the time. . . . The course of a military operation by the enemy is loaded with uncertainties. . . . It is our considered opinion that the conditions, as they appeared to the defendant at the time were sufficient upon which he could honestly conclude that urgent military necessity warranted the decision made. . . . The defendant may have erred . . . , but he was guilty of no criminal act.

I regard the Rendulic decision as an important guideline – and one not always followed by historians, some of whom, with hindsight and lacking the pressures of command, may have leapt to conclusions unduly critical of bombing during the Second World War,⁷ prompting responses by some participants.⁸ The issue is joined once again in two recent books, each of which makes reference to the corollary issues of the legality and morality of bombing in the Second World War. In Michael S. Sherry's *The Rise of American Air Power* the author intimates that more might have been accomplished between the wars to regulate warfare,⁹ while Ronald Schaffer, in *Wings of Judgment*,¹⁰ raises questions about the 'moral issue' of American bombing

policies during the Second World War. Both books are well-researched and thought-provoking. While Schaffer's book is more balanced, his very imprecise definition of the moral issue – 'a phrase that usually meant . . . the bombing of cities and civilians, though it also referred to air attacks on artifacts of civilization, such as libraries, cathedrals, monasteries, and famous works of art' – illustrates the difficulty of defining the subject of law and/or morality, or of determining the bomber's intent. More than reaching judgement, I will endeavour to identify the legal parameters available to the Second World War's military and civilian leaders, and their moral bases.

Development of the 'Just War' Tradition up to the First Hague Peace Conference

What is legal is not necessarily moral, and what is moral is not always legal; but particularly with regard to the law of war, the two are inextricably intertwined. Historically, civilians have seldom fared well in wars,¹¹ and it was primarily with their protection in mind that the modern law of war evolved. There is a certain irony in the realisation that the twentieth-century law of war traces its origins to the 'just war' tradition developed by clergy, international lawyers and philosophers from Western Europe – the principal strategic air battleground in the Second World War. But the limitations of the just-war tradition remain the shortcomings of the modern law of war: while there was general agreement on the propriety of resort to arms (*jus ad bellum*) and limited protection for the innocent (non-combatants) in the hands of a belligerent (a portion of *jus in bello*), the just-war tradition and the modern law of war are generally silent, or at least reluctantly acquiescent, regarding the actual use of force on the battlefield.¹²

At the heart of the just-war tradition and the modern law of war lies the principle of *discrimination*, which, in simple terms, means non-combatant immunity. But non-combatant immunity is not without exceptions. Within both the just-war tradition and the law of war, it has always been permissible to attack combatants even though some non-combatants may be injured or killed; so long as injury to non-combatants is ancillary (indirect and unintentional) to the attack on an otherwise lawful target, the principle of non-combatant immunity is met. There were two other conditions that are important to our consideration:

(a) Non-combatants forfeit their right of protection from intentional injury if they carry out actions in favour of one belligerent over another; and

(b) In the siege of a city, injury or death to non-combatants within the besieged city was regarded as permissible as it created a burden on the besieged commander – or was his responsibility owing to his refusal to surrender. If an offer of surrender was refused, then the besieging commander was justified in putting to the sword all within the besieged city – including non-combatant women and children – for their refusal to surrender. (While the latter practice had diminished by the nineteenth century, the law of war continued to place responsibility for civilian casualties in the hands of the besieged commander – and permitted the besieger to look upon their injury as not only permissible but an effective means of war against the morale of the besieged.) As a corollary of this rule, actions taken by the besieged that placed non-combatants at risk were the responsibility of the besieged commander.¹³

While the four Geneva Conventions for the Protection of War Victims of 12 August 1949 renounce any dependency on reciprocity in the treatment of prisoners of war, enemy wounded, sick, or shipwrecked, or enemy civilians in the hands of an occupying power, this renunciation of a portion of the just-war tradition was not extended to the conduct of hostilities.

One of the great ethical dilemmas that remains unresolved by the law of war is the just-war tradition that, where a war is clearly just, the general immunity of enemy non-combatants may be overridden in order to protect the very values that ultimately guarantee the safety of such persons.¹⁴ This argument formed the basis for justifications of bombing by both sides during the Second World War. However objectionable we may find it in today's world or by what we perceive to be today's moral standards, the matter remains unresolved. It continues to be an active element in Socialist military doctrine, has been cited by leaders of terrorist organisations – most of whom have been trained in Socialist nations – and has been relied upon by both sides in the Iran-Iraq War as justification for particular military actions, such as the war on each other's cities. However, the just-war tradition condemns indiscriminate bombing; the dilemma over the past century has been in identifying the line where military actions cease being permissible and become indiscriminate. As a leading moralist has noted, under the just-war tradition This distinction is not determined by the

amount of the devastation or the number of deaths, but by the direction of the action itself, i.e., by what is deliberately intended and directly done.¹⁵

The just-war tradition and law-of-war concepts were confronted with yet another dilemma with the arrival of the Industrial Revolution. Previously battles were open, pitched affairs, or involved an attempt to capture (usually through siege) a heavily defended city. A city or village might remain undefended because it contained nothing of military value, in which case it was open to physical occupation by the enemy. So long as the citizens of the village or city offered no resistance to an enemy force marching through or occupying the area, they were left alone, with one important exception: a naval force could approach an undefended coastal town for provisions and, if refused the supplies requested, could bombard the town to a degree proportionate to the severity of the refusal.

Up until the eighteenth century, wars were generally private affairs, fought between relatively small units. By that time, however, the modern nation-state system was emerging; there were full-time professional armies representing those states; there was a civilian bureaucracy to support the insatiable appetite of an army on the march; and the Industrial Revolution had led to the development of facilities that linked a nation together for reasons that were important to commerce in peace and defence when threatened, such as the railways. Not only were the railways important to the movement of units from one point to another at speeds much greater than was allowed by road march; for the first time they enabled a government to organise and mobilise a nation for war. A nation's leaders, in contemplating military operations against another nation, no longer thought of war solely in terms of uniformed battalions confronting uniformed battalions on a battlefield largely devoid of civilians; ways were considered to destroy or capture an enemy nation's economic or industrial capacity to wage war.

Such operations were first undertaken during the American Civil War, as Union General William Tecumseh Sherman carried out his famous march to the sea, cutting the Confederacy in half while destroying its industrial resources or denying it the ability to grow cotton for export in order to finance the war;¹⁶ the naval blockade conducted by the US Navy served similar purposes, not only preventing the import of war materials, but also denying the Confederacy the ability to export cotton – an action similar to the 'tanker wars' going on in the Persian Gulf in the

1980s and 1990s. Economic and industrial targets had become an important element in modern war. Railways and other lines of communication also had taken on significance, and foreign military observers of the American Civil War learned their lessons well. Railways were employed with great success by the Prussian military in the Franco-Prussian War.¹⁷

There was another development as a result of the nation-state system. Nations provided a sense of identity to their citizens, and an invading army frequently found itself faced with guerrillas – civilians of the invaded nation, often called *francs-tireurs*, who would offer armed resistance. Such units had been used to great effect during the American Civil War, particularly against Union Army supply lines, and France was to organise its *francs-tireurs* into an Auxiliary Army during the Franco-Prussian War.

The problems of guerrilla warfare are not a part of this paper. But the national use of *francs-tireurs*, coupled with the industrial mobilisation of a nation for war, illustrates the degree to which warfare had expanded in a nation's utilisation of its entire resources to advance its war aims. No longer was warfare merely a matter of a contest pitting soldier against soldier; it was a national effort. Able-bodied men were conscripted for military service, while all others – men, women, and children – assumed other responsibilities to support the war effort. And it was into this changing environment of war that international lawyers stepped to devise the modern law of war.

The first effort began in the United States during its Civil War. Faced with the problems of guerrilla warfare, President Abraham Lincoln gave Dr Francis Lieber the task of the preparation of a code of law for the Union forces. Lieber wrote two documents, one of which addressed the issue of guerrillas and the law of war; the second, adopted by the Union Army as General Orders No. 100, became the first modern statement of the law of war and the foundation for much of the law of war as it was to exist over the next century—including the Second World War.¹⁸ Several of its provisions relate to the question before us:

14. Military necessity, as understood by modern civilized nations, consists in the necessity of those measures which are indispensable for securing the ends of the war, and which are lawful according to the modern law and usages of war.

15. Military necessity admits of all direct destruction of life or limb of armed enemies, and of other persons whose destruction is incidentally unavoidable in the armed contests of war; it allows of

the capturing of every armed enemy, and every enemy of importance to the hostile government, or of peculiar danger to the captor; it allows of all destruction of property, and obstruction of the ways and channels of traffic, travel or communication, and of all withholding of sustenance or means of life from the enemy. . . .

20. Public war is a state of armed hostility between sovereign nations or governments. It is a law and requisite of civilized existence that men live in political, continuous societies, forming organized units, called states or nations, whose constituents bear, enjoy, and suffer, advance and retrograde together, in peace and war.

21. The citizen or native of a hostile country is thus an enemy, as one of the constituents of the hostile state or nation, and as such is subjected to the hardships of war.

22. Nevertheless, as civilization has advanced during the last centuries, so has likewise steadily advanced, especially in war on land, the distinction between the private individual belonging to a hostile country and the hostile country itself, with its men in arms. The principle has been more and more acknowledged that the unarmed citizen is to be spared in person, property, and honor as much as the exigencies of war will admit.

29. Modern times are distinguished from earlier ages by the existence at one and the same time of many nations and great governments related to one another in close intercourse.

Peace is their normal condition; war is the exception. The ultimate object of all modern war is a renewed state of peace.

The more vigorously wars are pursued the better it is for humanity. Sharp wars are brief.

General Orders No. 100 was to remain the principal law-of-war reference for the balance of the nineteenth century. Although efforts were made to develop the law of war relating to the conduct of hostilities into a treaty – including a conference held in Brussels in 1874 – none met with success. With the exception of a brief treaty for the protection of the wounded, the first real multilateral law-of-war negotiations would not occur until the closing years of the century.

Before the First World War: The First Hague Peace Conference

On 3 September 1898, acting on behalf of Tsar Nicholas II, Russian Foreign Minister Count Mikhail Muraviev proposed the convening of an international disarmament conference to ad-

dress issues relating to disarmament, the proscription or regulation of certain modern weapons of war, and establishment of a mechanism for arbitration of international disputes. In a letter dated 30 December 1898, and handed to diplomatic representatives in St. Petersburg on 11 January 1899, Count Muraviev listed eight proposals, two of which marked the beginning of efforts to regulate aerial bombardment.¹⁹

3. . . . Prohibition of the discharge of any kind of projectile or explosive from balloons or by similar means. . . .

7. Revision of the declaration concerning the laws and customs of war elaborated in 1874 by the Conference of Brussels, and not yet ratified.

While disarmament and peace groups were enthusiastic in their support for the Russian call for an international conference, the reaction of governments was underwhelming. Each of the invited nations accepted the invitation with suspicion, and without great expectations. The Russian invitation (correctly) was seen as lacking in altruism. The Russian Minister of War had determined that Austria, its principal rival, was about to procure an improved field-gun capable of firing six rounds per minute, six times the rate of comparable Russian field-pieces. The newer gun was already standard in the armies of Germany and France. Rather than embark on a major, costly arms procurement programme, the Russian Ministers of War, Finance, and Foreign Affairs considered alternatives. Rather than seek bilateral accommodation with the Austrians, whom the Russians did not trust, a solution was framed in terms of the multilateral negotiations proposed by Count Muraviev. The First Peace Conference was convened in The Hague on 18 May 1899, with delegations present from twenty-six nations.²⁰

The work of the conference was divided among three commissions. Commission I addressed disarmament issues, including the proposal for a prohibition on the discharge of explosives from airborne vehicles; Commission II, revision and codification of the law of war; and Commission III, international arbitration. Russian attempts in Commission I to limit force levels and budgets died in subcommittee sessions. Proposals by Russia to limit fleets, armour-plate, and naval gun sizes also were defeated, as were moves to ban submarines, torpedo boats, and naval mines. Three proposals met with moderate success: a limitation on the use of chemical weapons,²¹ a pro-

hibition on expanding (so-called 'dum-dum') bullets;²² and a five-year moratorium on the launching of projectiles and/or explosives from the air, this last being within the focus of this paper.

Balloons had been used for limited military purposes for some time.²³ The use of dirigible airships had been discussed in international conferences in Chicago in 1893 and Paris in 1899, and most delegates undoubtedly had some idea of where their respective national efforts were headed.²⁴ Many of the smaller or less-developed nations were quick to embrace the proposed prohibition as a way of disarming nations that were either more developed, or possessed a greater capacity for development.²⁵ Although slow in expressing their respective opposition, the delegates from France, Germany, Great Britain, and the United States were under instructions to oppose the prohibition.²⁶ The subcommission on land warfare of Commission I considered the Russian proposal for a prohibition on the discharge of explosives or projectiles from balloons or by 'similar methods' with little formal discussion, adding the word 'new' between 'similar' and 'methods' to clarify the proposal's intent. The proposal was adopted without consideration of a recommendation by the German delegate to limit the prohibition to a term of five years. With the exception of the delegate from Romania, who reserved his vote in preference for a limitation on the prohibition to a term of five years, and British abstention, the subcommission vote was unanimous in adoption of the resolution.²⁷

Nine days later, however, apparently following consultations with other members of his delegation and reconsideration of the Secretary of State's instructions to the US delegation, the US delegate to the subcommission, Captain William Crozier, an Army artillery officer, attempted to reopen discussion of the prohibition.²⁸ Crozier noted that²⁹

... it seems to me difficult to justify by a humanitarian motive the prohibition of the use of balloons for the hurling of projectiles or other explosive materials. We are without experience in the use of arms whose employment we propose to prohibit forever. Granting that practical means of using balloons can be invented, who can say that such an invention will not be of a kind to make its use possible at a critical point on the field of battle, at a critical moment of the conflict, under conditions so defined and concentrated that it would decide the victory and thus partake of the quality possessed by all perfected arms of localizing at important points the destruction of life

and property and of sparing the sufferings of all who are not at the precise spot where the result is decided. Such use tends to diminish the evils of war and to support the humanitarian considerations which we have in view.

I do not know of machines thus efficient and thus humanitarian, in the incomplete stage of development in which aerostation now is; but is it desirable to shut the door to their possible introduction among the permitted arms? In doing so, would we not be acting entirely in the dark, and would we not run the risk of error inherent in such a manner of procedure? The balloon, as we know it now, is not dirigible; it can carry but little; it is capable of hurling, only on points exactly determined and over which it may pass by chance, indecisive quantities of explosives, which would fall, like useless hailstones, on both combatants and non-combatants alike. Under such conditions it is entirely suitable to forbid its use, but the prohibition should be temporary and not permanent. At a later stage of its development, if it be seen that its less desirable qualities still predominate, there will still be time to extend the prohibition; at present let us confine our action within the limits of our knowledge.

That is why I have the honor to propose the substitution of the following text for the text already voted:

For a period of five years from the date of the signature of this act it is forbidden to employ balloons or other similar means not yet known for the purpose of discharging projectiles or explosives.

The President of the subcommission declined Captain Crozier's amendment, suggesting that he raise the matter in the next plenary session of Commission I, which was held two weeks later. Captain Crozier's presentation at that subsequent meeting was briefer, but to the point. It was correct to limit aerial bombardment at this time,³⁰

Since it is impossible to foresee the place where the projectiles or other substances discharged from a balloon will fall and since they may just as easily hit inoffensive inhabitants as combatants, or destroy a church as easily as a [artillery] battery. However, if it were possible to perfect aerial navigation in such a way as to do away with these defects, the use of balloons might decrease the length of combat and consequently the evils of war as well as the expenses entailed thereby.

Crozier's amendment proposing a five-year moratorium enabled the delegates to take a 'wait and see' attitude towards

aeronautical developments and postpone any decision until the second Hague Peace Conference, while gaining unanimity for the proposal under consideration. Crozier's amendment was accepted by Commission I, and ultimately the Conference adopted a Declaration prohibiting 'for a term of five years, the launching of projectiles and explosives from balloons, or by other new methods of a similar nature'.³¹

Crozier's action has been credited with saving the prohibition – at least at the first conference.³² In all likelihood this analysis is correct, for with several major powers unwilling to accept an unlimited prohibition – and it seems certain that it would not have been accepted by France, Germany, Great Britain, or the United States – it is unlikely that other nations would have accepted the prohibition unilaterally. But Captain Crozier's amendment also changed the focus of the debate from prohibition of aerial bombardment, a disarmament issue, to regulation of aerial bombing, a law-of-war area.

Disarmament advocates anticipating the First Hague Peace Conference were dismayed by Count Muraviev's proposal for 'Revision of the declaration concerning the laws and customs of war . . .',³³ as the law of war constituted an acceptance of the inevitability of war, rather than striving for general disarmament and world peace. The law of war also was viewed with pessimism by some military delegates to the conference, but for different reasons. For these men it seemed impractical to speak of moderation in war.³⁴ The pessimism had two bases. The first was the philosophy expressed in article 29 of the Lieber Code – that the more vigorously wars are pursued, the briefer they will be, and the less humanity will suffer. This philosophy has never been rejected by any nation, and in fact was a part of the basis for the US employment of atomic weapons against Hiroshima and Nagasaki in 1945.³⁵ A corollary is manifested by the comments of Vice-Admiral Fisher (quoted in note 34): that a promise of prosecution of a war without moderation may deter aggression by others. This theory of deterrence was adopted by air-power advocates, and pursued with vigour by a number of nations – commencing with the writings of Giulio Douhet,³⁶ but argued subsequently by General Billy Mitchell and Air Marshall Hugh Trenchard. It is not my intention to join the debate over the degree to which the between-the-wars air-power planners were influenced by Douhet, or the degree to which air power contributed to the Allied victory in the Second World War, but rather to illustrate that there existed a philosophy that militated

against the regulation of war-fighting as such.

The second argument against regulations moderating war is more practical. It comes from the degree of control a nation or its military forces have over the implementation of the law of war. Where a nation has total control over law-of-war implementation, the law of war has been moderately successful. But where the law of war is largely dependent upon the good faith of other nations, both promulgation and implementation of the law have been substantially less successful.

Thus, regulations related to care for and protection of enemy prisoners of war have proved successful because the captor has complete control of the situation. If an enemy soldier resists after capture, or attempts escape, the captor has the ability to resolve the matter to his favour. But this is not the case with rules that affect the employment of force. A rule proposing moderation in the use of weapons systems – ostensibly for the protection of the civilian population of an enemy nation, or the civilians of a friendly nation occupied by an enemy – is dependent upon respect for the law by both the attacker and the defender. But international law has no effective enforcement mechanism, and a malevolent belligerent – whether attacker or defender – stands to gain potentially significant tactical advantages over a law-abiding opponent. It was this concern that drew military men up short in their support for the regulation of hostilities. As international law scholar Julius Stone was to conclude years later, 'It is far easier to moralize about air attacks on civilians, and to offer soothing verbal solutions, and to dismiss target area bombing as probably unlawful, than to frame rules for mitigation of human suffering with some hope of belligerent observance amid the realities of modern war.'³⁷ It was this problem that was to plague law-of-war negotiators at the First Hague Peace Conference, and all succeeding conferences to the present day.

Commission II was assigned the responsibility for codification of the law of war, which it did with moderate success in Hague Convention (II) with Respect to the Laws and Customs of War on Land.³⁸ Article 23(g) of its Annexé to provided that '... it is especially prohibited ... to destroy or seize the enemy's property, unless such destruction or seizure be imperatively demanded by the necessities of war.'³⁹

In applying this principle, a fundamental corollary has been the principle of discrimination; that is, that military violence will be directed towards military targets. The two articles in

Hague II applicable to aerial bombardment state:

25. The attack or bombardment of towns, villages, habitations or buildings which are not defended, is prohibited.

27. In sieges and bombardments all necessary steps should be taken to spare as far as possible edifices devoted to religion, art, science, and charity, hospitals, and places where the sick and wounded are collected, provided they are not used at the same time for military purposes.

The intent of these articles was to codify existing practice, rather than to create new law.⁴⁰ But there are matters of significance to this conference associated with articles 25 and 27:

'Undefended' town. The term was well-defined in practice, but remained undefined in the treaty, perhaps because it was assumed the term was commonly understood. Because the treaty did not define the term, however, it was to cause a great deal of confusion in the years that followed. One scholar noted the background of the term:⁴¹ 'Unfortified cities were not attacked because they were not of sufficient military importance, and all that was necessary to take them was to march in without the necessity of resorting to bombardment.' The term had but one meaning, as previously stated: it was a town or city lacking military defences and open to physical occupation by the enemy. And yet it created problems. When during the First World War the Zeppelin raids commenced, British defence authorities hesitated in placing anti-aircraft guns in and about London for fear that such gun placement would make the city 'defended', and therefore subject to attack – or, conversely, in the hope that the city would be legally immune from attack so long as it contained no gun emplacements.⁴²

Either interpretation would have been incorrect. As a German delegate observed, article 25 was not intended to prohibit the intentional destruction of any buildings whatsoever, and by no means so when military operations rendered this necessary. His observation met with no objection in the subcommission, and was noted in the subcommission's report of 5 July 1899.⁴³ Yet a misunderstanding of 'undefended towns' was to plague politicians, military planners, international lawyers and historians for years to come.⁴⁴

The reciprocal nature of the law of war. The law of war succeeds only in so far as it does not provide – or appear to provide – an opportunity for one party to gain a tactical advantage over

another. The delegates to the First Hague Peace Conference recognised this in the language of article 27, which provides limited protection for certain civilian objects – such as hospitals, museums, and schools – so long as each is not being utilised for military purposes. Although article 27 essentially is addressing minimisation of collateral damage, it has a kinship to the prohibition contained in article 23(g) on intentional attack on all civilian property. In retrospect, it would have been wiser for the delegates to have made a clearer connection between the concepts expressed in these two articles.

Issue-avoidance. The delegates to the First Hague Peace Conference attempted to codify the law of war only to the extent consensus could be reached. Controversial areas, such as reprisal, were avoided, as was any acknowledgement of the inevitability of collateral or incidental civilian casualties in modern war. The delegates addressed (obliquely) the subject of collateral damage to civilian objects in the admonitory language of article 27; but the issue of collateral civilian casualties was ignored – or avoided. Perhaps this was due in part to the fact that extension of a conflict beyond the immediate battlefield could not be contemplated. Yet more could have been said, and was said thirty-six years earlier by the Lieber Code:

Art. 15. Military necessity admits of all direct destruction of life or limb of armed enemies, and of other persons whose destruction is incidentally unavoidable in the armed contests of war. . . .

The First Hague Peace Conference passed into history. After five years, the prohibition on discharge of explosives from balloons or by other new methods contained in Hague Declaration (IV, 1) lapsed. Moves were afoot for a second conference, but the formal call for a conference had to be put off for a number of reasons, not the least of which was the conclusion on 5 September 1905 of the Russo-Japanese War. Although President Theodore Roosevelt earlier had been approached to propose a second conference, and actually had begun steps in that direction in 1904, he relinquished that privilege to Tsar Nicholas II following receipt of a request to that effect delivered by the Russian Ambassador to Washington.

The Second Hague Peace Conference

A great deal had occurred since the First Hague Peace Conference that would affect the second conference, which convened at the Hague on 15 June 1907. The Wright Brothers had accomplished man's conquest of the air; their efforts, along with those of Alberto Santos-Dumont, were watched carefully in both the public and private sectors. France, Germany, Russia and Italy had commenced programmes for the production of military dirigibles; the threat of attack from the air loomed larger. But domestic politics also had come into play; the Liberal Government of Great Britain was committed to a reduction of its military and naval budgets. The Tsar's call for a second conference eschewed limitation-of-armaments issues,⁴⁵ as Russia, with recent military defeat behind it, was more interested in undertaking an arms build-up than it had been at the time of the First Hague Peace Conference. While Britain was anxious to add disarmament to the conference agenda, Germany made it clear that its delegates would walk out of the conference if the subject of disarmament were raised. All of these matters have been discussed in greater detail elsewhere, and will not be belaboured here;⁴⁶ but they set the tone for the conference.

The prohibition on the delivery of munitions from aerial platforms was considered for renewal with the issue assigned to the First Subcommission of the Second Commission. Some opposition to the renewal was expressed, in part because of the restriction on bombardment contained in article 25 of Hague II of 1899. Ultimately the prohibition was renewed, but rather than for another set term of five years, it was left in effect until the Third Hague Peace Conference. That never occurred, and the treaty – in its subsequent form known as Hague Declaration XIV of 18 October 1907⁴⁷ – is generally regarded as of no legal significance.⁴⁸ Of historical interest (but not significance) is that while France, Germany, Italy, Japan, Russia and the United States ratified the 1899 prohibition, while Great Britain did not, only Great Britain and the United States committed themselves to the 1907 treaty. However, since the treaty was only binding in case of war between parties to it, the treaty would have been of no effect in either world war.

The prohibition essentially had been supplanted by language amending article 25 of the Annex to the 1899 Hague Convention II. In its subsequent form as article 25 of the Annex to the Hague Convention IV of 18 October 1907, article 25 reads:⁴⁹ 'The

attack or bombardment, *by whatever means*, of towns, villages, dwellings, or buildings which are undefended is prohibited [*italics indicate the amending language*].'

Attempts to bring naval forces under the rubric of the 1899 Hague II had proved unsuccessful at The First Hague Peace Conference, and became part of the Tsar's agenda for the second conference. This endeavour proved successful, but not without adding to the confusion in the process. Hague Convention IX Concerning Bombardment by Naval Forces in Time of War provided clearer rules – and authority – than did either the 1899 Hague II or its successor, the 1907 Hague IV.⁵⁰ While repeating the restrictions on bombardment contained in Hague IV (as well as the prohibition on attack of undefended towns, again without definition of the term), article 2 identified particular military objects that could be attacked, and recognised the inevitability of collateral damage in the execution of such attacks. While this created further confusion in interpretation of the law of war, some feeling (erroneously) that naval forces had greater latitude in the execution of attacks than ground forces, a review of the negotiating record indicates that the drafters of Hague IX were simply more equal to their task. With the exception of naval authority to engage in punitive bombardment of an undefended city if its requisition of supplies were declined, the obligations and authority regarding bombardment were essentially the same – and were intended to be.⁵¹

Hague IX was significant for other reasons. It was the first treaty codification, or acknowledgement, that bombardment (or bombing) was related to the military significance of the target rather than whether or not the city, town or village in which the target was located was defended.⁵² It also served to confirm the permissibility of attacking targets wherever located. It provided the only list of lawful targets contained in any law-of-war treaty and this, while incomplete by First and Second World War and modern standards, none the less was an improvement over past and future treaties.⁵³ Article 2 lists as lawful targets 'military works, military or naval establishments, depots of arms or war matériel, workshops or plans which could be utilised for the needs of the hostile fleet or army, and the ships of war in the harbour.' Thus lawful targets were not limited to objects purely military in nature, but included industrial targets of value to the enemy war effort. The list was regarded by the head of the US delegation as declaratory of customary international law as it existed in 1907.⁵⁴

What was of equal importance was that the treaty absolved the attacker of responsibility for 'unavoidable' collateral damage. This was not new law; this, again, was a codification of the customary practice of nations. What must be realised is that collateral civilian casualties were regarded as the cost of war to a nation rather than the responsibility of the attacker. As one international law scholar of the time noted:⁵⁵

Bombardment of the resident portions of towns. – It has been questioned whether towns separated somewhat from the fortifications which defend them are liable to bombardment. This is a part of the larger question as to whether the portions of towns not used for military purposes are exempt from bombardment. It must be admitted, however, that this is one of the rigors of war which belligerents have held to be so useful as not to be given up. Of its hardship there can be no question, though it cannot compare with that of a siege.

As previously noted, collateral civilian casualties during a siege were regarded as a burden upon the besieged commander – an inducement to end the siege. Bombardment not connected to a siege but resulting in collateral civilian casualties was not illegal; it was merely the price of doing the business of war.

From an academician's standpoint, the Second Hague Peace Conference might be regarded as a disaster. Lawyers on the United States delegations to the 1899 and 1907 conferences sought to regulate (if not prohibit) 'uncontrollable forces dangerous to neutrals or noncombatants'.⁵⁶ There had been partial success in that article 1 of Hague Convention VIII 'Relative to the Laying of Automatic Contact Mines' required self-neutralisation mechanisms on unanchored naval contact mines, on anchored naval contact mines that broke loose from their moorings, or for torpedoes that missed their target. This was not a great international law achievement, however, inasmuch as such a proscription was consistent with prudent military practice: the free-floating mine or torpedo posed a threat to its own forces as much as to enemy or neutral shipping.

An increasing capability for controlled flight had destroyed for ever any chance of prohibiting bombing in future conflicts. One international lawyer viewed the outcome of the 1907 Hague Peace Conference as a 'direct retrogression from the humanitarian viewpoint', inasmuch as the conferees were unable to 'restrict the means of warfare to those heretofore employed'.⁵⁷ This position manifests a fundamental problem with codifi-

cation of the law of war, in that some international lawyers all too frequently wish to roll the clock back to the 'good old days' of warfare, while concluding that any progress in technology must be less humane. Each premise is erroneous. But rather than work with change, there has been – and continues to be – a resistance to change, and codification has suffered accordingly.⁵⁸ The result is basic to this paper, and the questions it raises; the rules codified in 1907 at The Hague were the rules in effect when war broke out thirty-two years later, unchanged by any subsequent treaty. I have dwelt at length with the Hague Peace Conferences of 1899 and 1907 for this reason. Those conferences were the first – and last – successful effort at codification of regulations affecting combat operations.⁵⁹ There were subsequent law-of-war treaties dealing with military wounded and sick, hospital ships, prisoners of war, and chemical and bacteriological warfare; but the rules formulated in 1899 and 1907 provided the only law-of-war guidance available to the military men who planned and executed the air campaigns of the Second World War.

Efforts to continue codification of the law of war began at the Second Hague Peace Conference. In the Final Act of that conference, the conferees recommended that a preparatory committee appointed by governments should begin planning for the Third Hague Peace Conference – which they recommended should be held in 1914 – two years in advance of the conference.⁶⁰ Arrangements for a third conference had begun, but were overcome by the commencement of the First World War. This may have been propitious. As Lee Kennett has noted, 'In the years leading up to 1914, the major powers had given little attention to the legal and moral implications of the weapons they were developing. Most of them were preoccupied with the technical aspects of bombing.'⁶¹

Had a Third Hague Peace Conference been held on the eve of the First World War, there is a strong possibility that the progress in codification of the law relating to aerial bombardment that was accomplished at the first two conferences might have been lost altogether. Although Hague IV and IX were intended to be no more than a codification of the customary practice of nations and, properly read, relieved an attacker of any responsibility for collateral damage or collateral injury short of indiscriminate bombing, nations are reticent to regulate a new means of war with rules that might have the potential of hampering its effective employment, or limit its use against an

opponent who has no concern for the law of war. At a meeting of the Institute of International Law in 1911 some members continued to press for the abolition of the aeroplane as a weapon of war, while others urged special rules for its employment. But rules are made by nations, and any such attempt to slow the advance of aviation in the years immediately preceding the First World War would have been much the same as the proverbial broom sweeping to hold back the tide.

The aerial bombing campaigns of the First World War – the Zeppelin and Gotha offensives, the Allied counteroffensives (executed or planned), and other bombing operations – have been described elsewhere.⁶² It is obvious that law-of-war considerations received little (if any) attention, except as a tool for propaganda alleging indiscriminate attacks by the enemy. Several observations can be made about the campaigns conducted by the warring parties, however:

1. The practice of the various nations provided a fairly clear indication of the types of objects regarded as lawful targets: military and naval bases; warehouses, airfields, and docks; lines of communication; and industrial targets that offered a contribution to the enemy's war effort. (The degree of contribution established the priority of attack, not the legality of the target.)

2. While industrialisation of the modern European societies and mobilisation of their citizenry for 'total war' further clouded the distinction between combatant and civilian, bombing operations were regarded as analogous to naval blockade or siege, in which the blockader or besieger saw collateral injury as a natural, inevitable, and lawful consequence of such operations. In the very best case, collateral civilian casualties resulting from the attack of a legitimate target were not regarded as the responsibility of an attacker, as the ability to limit such casualties lay more with the defender or, for that matter, the civilian population itself. This was the case with regard to civilians in the vicinity of ground-combat operations, and no special legal regime to the contrary had been proposed – much less established – for aerial bombardment.⁶³

3. Whether a particular operation was regarded as 'illegal' or 'immoral' depended entirely upon whether the person was the bomber or the 'bombed', that is, the recipient of the bombs.

4. Bombing did have an effect upon morale on both sides. German steel-manufacturers reported a 30 per cent decrease in

worker efficiency during the period of air attacks on the Saar and Lorraine-Luxembourg in 1916,⁶⁴ while British Minister of Munitions Winston Churchill, in a meeting of the War Cabinet on 1 October 1917, established that German air raids on preceding nights had had a pronounced effect on employee attendance and production at Woolwich Arsenal. As the official British history noted, '... the loss of output was out of all proportion to the percentage of employees who stayed away from work'.⁶⁵ I mention this not to enter into the debate as to the efficacy of attacks on morale,⁶⁶ but to suggest that both sides in the First World War had experience to indicate there was value in such attacks. Certainly the theory of demoralising the enemy in this way was consistent with the theory of collateral casualties as a burden on the commander of a besieged area.

5. Sufferings visited upon the civilian population occurred more through errors in target identification and/or bombing accuracy than malice aforethought, and were compounded as air defences improved. Strengthening defences forced each side to resort to the cover of darkness in carrying out its attacks, which had a concomitant effect on target identification and bombing accuracy. It was a vicious circle of cause and effect that was to repeat itself in the Second World War and, more recently, in the US air strike against Libya in April 1986.⁶⁷

6. Airpower did not cause the greatest civilian suffering during the First World War; the British naval blockade of Germany during and after the war resulted in the deaths of a far greater number of civilians – especially women, children and the elderly – than did the strategic bombing offensives of both world wars combined.⁶⁸

7. However inaccurate, bombing was not the least discriminate weapon of the First World War. That distinction lay with the German Paris Gun which, firing from distances of up to seventy-five miles, could be aimed only at the centre of Paris. Used in conjunction with the German offensive of March 1918, it had but one purpose: an attack upon the morale of the citizens of Paris.⁶⁹ As its use was generally regarded as lawful by international law scholars, statesmen and military men of the time, it would be difficult to conclude that the more discriminate bomber was not legal, or that collateral civilian casualties were regarded as something other than an inevitable consequence of war.

Yet post-war periods inevitably bring efforts at modernisation of the law of war, as was seen with the two Hague conferences, and the years following 'The War to End All Wars' were to prove no exception. While aerial bombardment may have been regarded as lawful, a 'bombing mania' had begun that would build until the beginning of the Second World War. This fear of bombing would have an effect disproportionate to its military effectiveness.⁷⁰ This would have a fourfold, contradictory effect on inter-war disarmament discussions and military planning that would nullify the former while deceiving the latter: (a) Fear of bombing would lead to public pressure for a prohibition or regulation of bombing, which (b) could not be accomplished unilaterally or in any way that was dependent upon trust in a 'piece of paper'; this same fear (c) would produce a counter-argument for bombing as a war deterrent or, should deterrence fail, (d) would be justification for the use of bombing to attack the will (morale) of the nation in order to exploit an obvious fear – an enlargement upon the acceptance of collateral casualties in a siege as a burden placed upon a defender.

Strategic bombing was vertical envelopment of an enemy's military forces to attack a nation's means for waging war. Coupled with this was the determination by many nations, but particularly Great Britain, to avoid a repetition of the battlefield carnage that cost many nations almost a generation of young men; air power offered a substitute for land battles – which meant that a nation was prepared to substitute the loss of enemy civilian lives for the loss of enemy military and, of course (in theory), losses among its own military. During the 'no more war' years of post-war isolationism, it also offered an excuse for non-intervention in European crises; a nation with a small peacetime army has no means with which to intervene on land.⁷¹ But the dependency of each nation on foreign commerce made isolationism virtually impossible. Increasingly that commerce relied upon aviation, which reinforced the potential threat. The hope lay with (in today's vernacular) 'mutual and verifiable' disarmament or, failing that, an updated law-of-war treaty to regulate bombing. The moment of opportunity came in the years immediately following the First World War. As will be seen, it came – and went.

The Treaty of Versailles

The conclusion of the First World War brought an attempt at unilateral disarmament: under the Treaty of Versailles, Germany was to dispose of all aviation-related equipment; its military was to be disbanded. Although Germany submitted to the Versailles Treaty, it did not acquiesce totally. Germany stated it was prepared to submit to any limitation of aerial capabilities to which all members of the League of Nations were subjected, a proposal that was rejected by the victorious nations. A game of legal and diplomatic intrigue followed, continuing for almost two years, as (in the words of one historian), 'the Allies attempted to contain Germany's air potential through legal restraints that Germany assiduously tried to avoid'.⁷² Fulfilment of other parts of the Treaty of Versailles also suffered from an inability of enforcement. A desire to bring to trial certain former German military officers for war crimes related to Germany's aerial attacks on Great Britain brought this cautionary advice from the British Air Council:⁷³

... the present situation makes it necessary to emphasize the peculiar reverberation of such contemplated prosecutions upon the RAF. These German officers and men are to be tried in time of peace before a court exclusively composed of their ex-enemies for acts which do not differ from those ordered to be carried out by the Royal Air Force upon German towns. The orders given included directions to bomb German towns (where any military objective was situated), to destroy the industrial activities there by bombings during the day, and to weaken the morale of the civilian inhabitants (and thereby their 'will to win') by persistent bomb attacks which would both destroy life (civilian and otherwise) and should, if possible, originate a conflagration which would reduce to ashes the whole town and thereby delete a whole centre of industrial activity.

This highly legalistic Allied approach to maintaining the peace – or keeping Germany disarmed – failed in virtually every respect, and should have served as a clear indication of the difficulty of arms control or regulation of hostilities through legal documents lacking an effective means of enforcement.

The Washington Naval Conference

But greater, multilateral disarmament steps were envisaged. At the Conference on the Limitation of Armament held in Washington (21 November 1921 to 6 February 1922) representatives from the United Kingdom, France, Italy, Japan and the United States initially considered a total prohibition on new methods of warfare such as submarines, poisonous gas and aircraft. But there was distrust among nations who were allies only three years earlier,⁷⁴ which ultimately led to a conference conclusion that it was 'not at present practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military'.⁷⁵ When it became apparent that prohibitions were unlikely, the delegates turned to the possibility of 'rules for control of new agencies of warfare', suggesting regulation rather than limitation. It was obvious the issue could not receive adequate consideration in the limited time remaining at the conference. On 9 January 1922 the delegates unanimously accepted a recommendation that aircraft should operate only within rules established by a subsequent conference. That subsequent conference was to consider a number of issues, including the following: 'Do the existing rules of international law adequately cover new methods of attack or defence resulting from the introduction or development, since The Hague Conference of 1907, of new agencies of warfare? If not, what changes in existing rules ought to be adopted as a part of the law of nations?'

Thus the first post-war consideration of aerial bombardment ended inconclusively, with the issue passed to a separate conference.⁷⁶ The latter conference, desired less by governments than by public opinion, convened in The Hague on 10 December 1922. But if the actions of United States officials are an indication of the approach each nation was to take towards the conference, it was doomed before it began.

The Hague Commission of Jurists

Certainly the United States sought to send a strong delegation, to be headed by Ambassador John Bassett Moore, a member of the Permanent Court of International Justice at The Hague. Military representation was equally impressive, to include Rear Admiral W. L. Rodgers, USN, a former President of the pres-

tigious Naval War College. But at the outset US delegation guidance had to be prepared, and there was a clear divergence of views between the Army and the Navy. Draft rules relating to aerial bombardment proposed by the Secretary of the Navy were more restrictive than those proffered by the Secretary of War. Although both sets of draft rules were passed to the US delegation by the Secretary of State, the Navy rules very early became the basis for US delegation negotiation. There were several reasons for this. The Navy rules closely paralleled those proposed by the British delegation. But Ambassador Moore's decision appears to have been influenced considerably by Admiral Rodgers, the senior military member of the delegation.⁷⁷ The guidance to Ambassador Moore from the Secretary of State left it to Moore as delegation head to decide between the Navy and War Department drafts. Admiral Rodgers proved more persuasive than his Army Counterpart, Brigadier General William H. Johnston, despite the fact that Major William C. Sherman, an early proponent of long-range aerial bombardment and protégé of Brigadier General Billy Mitchell, was General Johnston's aviation adviser on the US delegation.

The point of view of the US Navy and the British was influenced more by the internecine fighting over post-war defence budgets within each nation than by humanitarianism. Both navies had been experimenting with and developing aircraft-carriers for more than a decade.⁷⁸ While the Royal Naval Air Service had conducted bombing raids during the First World War, and US Army Brigadier General Billy Mitchell had raised international interest when Martin bombers under his command sank the 'unsinkable' German battleship *Ostfriesland* on 21 July 1921 sixty miles off the Virginia coast,⁷⁹ the aircraft-versus-battleship controversy was far from over in either nation or, for that matter, in their respective navies.

Aircraft-carrier development in the immediate post-war era was prompted by several events. The Royal Air Force had been established on 1 April 1918, and Marshal of the Royal Air Force Trenchard's strong voice in favour of strategic bombing was beginning to be heard, as was Brigadier General Billy Mitchell's in arguing for an independent air service in the United States. The Washington Naval Conference that had proposed the forthcoming Hague Conference to regulate aerial warfare adopted capital-ship limitations that ultimately led to the completion of the US battle-cruisers *Lexington* and *Saratoga* as aircraft-carriers; the decision not only was greeted with enthusiasm by naval

aviators, but viewed by battleship sailors as a counter to the move for an independent air service. The Royal Navy took similar steps, converting the light battle-cruisers *Courageous* and *Glorious*. Both navies essentially regarded the carriers and their aircraft complement as scouting rather than offensive forces; and even if used for bombing operations against land targets, the range of their aircraft would not have been significantly greater than that of naval gunfire, and the weight of the attack considerably less. Hence naval 'humanitarianism' in the forthcoming Hague meetings was fundamentally self-protection. There also was a tinge of national security interest. Japan completed its first aircraft-carrier, the *Hosho*, in December 1922, and a British test pilot made the first landing on her deck, three days after the conclusion of the 1923 Hague conference.⁸⁰

But Britain's greatest threat remained France, whose air-power capabilities were on the rise. Having learned the painful lesson during the First World War that Great Britain no longer was an island, the British were quite anxious to place limitations on the ability of any potential enemy to attack the British Isles. For Britain, development of limitations on strategic bombing would serve economic as well as national security purposes, while US interests were limited to the former.

The consideration within the US and British delegations up to this point was with the legality of targets and the depth of the extended battlefield. Another question was the issue of collateral damage to civilian objects or injury or death to civilians. The draft US Army rules provided in part: 'In conducting a bombardment [by air], the obligation of a belligerent is discharged if due care is exercised not to injure objects which happen to be in the vicinity of the permitted target . . .'. The US Navy rules stated: 'Injuries to non-combatants and to places excluded [by the rules] which is incidental to legitimate bombardment cannot be regarded as unlawful, but it shall be the duty of the belligerent conducting a bombardment to exercise due care to confine the injury as much as possible to the objectives not prohibited.'

There are two noteworthy matters contained in these drafts. The Navy provision was the first to address the issue of collateral injury to non-combatants, while both the Army and Navy proposals established ordinary care as the standard for an attacker in carrying out an aerial attack.

The Commission of Jurists and their Military and Naval Advisers convened at the Hague on 11 December 1922, with

delegations in attendance from the United Kingdom, the United States, France, Italy, Japan and The Netherlands; Germany, still ostracised by her former enemies, was not invited. The charter enjoined negotiators to consider the following areas: regulation of the use of radio in time of war, and aviation in time of war, to include regulations for aerial bombardment. During the first ten days of meetings, discussion focused on the British and American drafts. Following adjournment for the Christmas and New Year's holidays, two subcommittees were formed to address separately the issues related to radio and aviation. The Subcommittee on Aviation met from 8 January through the balance of the month, at which time plenary sessions of the Commission resumed.

John Bassett Moore, writing after the conference, observed that 'From the beginning of the sessions . . . it was generally felt that perhaps the severest test of the possibility of a general agreement would be found in the efforts of the Commission to regulate the subject of bombardment from the air.'⁸¹ Although similar in effect, the British and American drafts differed in their approach to the issue. The British proposal phrased its draft in terms of attacks upon 'military objectives', without defining the term, while the US draft designated specific objects which might or might not be bombed while avoiding the use of the terms 'military objective' or 'military target'. As Ambassador Moore observed, 'The British delegation set great store by the phrase "military objective" as having a limitative effect, while the delegation of the United States thought the phrase left too much to the discretion of the individual commander.'⁸²

While all subcommittee members favoured adopting rules that would protect the civilian population, there was disagreement as to the best way in which to reach this objective or as to the terms in which these rules should be expressed. Japan and The Netherlands were in favour of the greatest restriction on bombing, to include a total prohibition on bombing outside the immediate area of military operations; and subcommittee members were unanimous in accepting the principle that enemy forces, military works, lines of military communication, military or naval bases, and depots of arms, ammunition, or war matériel could be attacked. But no draft formula gained a majority of votes; the fundamental difficulty was 'the determination of the conditions under which the bombardment of objects, intrinsically liable to attack, was to be forbidden, when they were found in centres of population'.⁸³

The issue as described begs the question in two respects. First, it assumes that a lawful target situated in a populated area should be protected from attack. Such a rule would invite mischief on the part of a defender, who could resolve target vulnerability problems simply by constructing high-value targets in populated areas, or encouraging urban growth around pre-existing targets. The United States learned this to its regret – and at the cost of many aircraft and the loss of many American lives – in the Rolling Thunder bombing campaign conducted against North Vietnam from 1965 to 1968. At the outset of that campaign Secretary of Defense Robert McNamara placed off limits targets located in populated areas, and personally selected all fixed targets authorised for attack. In response, the North Vietnamese stored war materials, parked military convoys, and located air-defence sites (fighter aircraft, anti-aircraft guns, and surface-to-air missile sites) in populated areas, making them immune from attack under the restrictions established and openly publicised by Secretary McNamara.⁸⁴

The second error was the assumption that responsibility for the avoidance of collateral civilian casualties or damage to civilian objects should be shifted to the attacker. It is a shared obligation of the attacker, the defender and the civilian population. The objective of a defender's anti-air forces is to protect military targets from attack through defences that either destroy attacking aircraft or cause those aircraft to miss the target; and the bomb that misses its intended target (or the crashing aircraft) may cause damage to civilian objects or injury to civilians in the vicinity of the target. Thus if a defender has succeeded in forcing the attacker to miss the target, in so doing he has knowingly placed his civilian population at greater risk.

In this sense, there is a collateral error, in that there exists an assumption that responsibility for incidental damage or injury always can be attributed to someone; yet when an attacking force is carrying out a lawful attack on a legitimate target, and the defender is utilising his anti-air capabilities lawfully to defend targets, responsibility for collateral damage, injury or death usually will be shared, or may be attributable only to the fog of war. In many cases the actions of the attacker may be consistent with the law of war, yet actions of the defender will cause the attack to result in collateral civilian casualties. The actions of the defender are an intervening cause for which the attacker is not responsible. This concept, though unstated as such, has been recognised in naval and land warfare for years.

Thus a naval blockade may prevent food from reaching an enemy, though there are admonishments in the modern law of war that a blockade should not be intended to starve the civilian population. The nation executing the blockade agrees to permit sufficient food through for the civilian population, which the defender promptly gives to his military; and the civilian population starves. The nation executing the blockade, when faulted for starving innocent civilians, would counter that it was the intervening action of the defender that caused the civilians to starve. That defence would be appropriate. Yet for inexplicable reasons the general public, diplomats and international lawyers have had difficulty in applying this same concept to the actions of a defender in an aerial attack.⁸⁵

Finally, the civilian population and individual civilians must assume some common-sense responsibility for the risks of war. The individual civilian who continues to live adjacent to a factory or other facility that clearly would be a lawful target must assume a certain degree of risk for his or her decision. Both Germany and Great Britain recognised this during the Second World War by evacuating non-essential personnel from cities or areas containing military targets, or by requiring those who remained to construct individual air-raid protection or move to air-raid shelters during an attack.⁸⁶

The delegates at The Hague in February 1923 had difficulty reconciling these problems with a desire to improve protection for the civilian population. The Aviation Subcommittee turned the matter over to the overall committee, which reduced the issue to two drafts, one Italian, one American, in which there was substantial difference. Following a plea to all conferrors by Ambassador Moore, the elected chairman of the Commission, the delegates worked for the next five hours to draft the following, which were adopted unanimously.⁸⁷

Art. 22. Aerial bombardment for the purpose of terrorizing the civilian population, of destroying or damaging private property not of military character, or of injuring non-combatants is prohibited.

Art. 23. Aerial bombardment for the purpose of enforcing compliance with requisitions in kind or payment of contributions in money is prohibited.

Art. 24. (1) Aerial bombardment is legitimate only when directed at a military objective, that is to say, an object of which the destruction or injury would constitute a distinct military advantage to the belligerent.

(2) Such bombardment is legitimate only when directed exclusively at the following objectives: military forces; military works; military establishments or depots; factories constituting important and well-known centres engaged in the manufacture of arms, ammunition or distinctively military supplies; lines of communication or transportation used for military purposes.

(3) The bombardment of cities, towns, villages, dwellings or buildings not in the immediate neighbourhood of the operations of land forces is prohibited. In cases where the objectives specified in paragraph (2) are so situated, that they cannot be bombarded without the indiscriminate bombardment of the civilian population, the aircraft must abstain from bombardment.

(4) In the immediate neighbourhood of the operations of land forces, the bombardment of cities, towns, villages, dwellings or buildings is legitimate provided that there exists a reasonable presumption that the military concentration is sufficiently important to justify such bombardment, having regard to the danger thus caused to the civilian population.

The problem of aerial bombardment was the most important and the most difficult with which the commission had to deal. While nations generally agree with the principle of discrimination – from the standpoint of military efficiency as well as humanitarianism – there were in 1923, and remain today, fundamental problems with codification of appropriate language that would be equally applicable to all nations, under all circumstances, and that would not provide a tactical or strategic advantage to one nation over another, nor establish rules for aerial bombardment that are fundamentally different from those applicable to land-based artillery or naval gunfire. The Hague Air Rules, adopted by the commission upon conclusion of its meetings on 19 February 1923, were unsuccessful in accomplishing this. While espousing humanitarian rules, in the words of Admiral Rodgers, . . . each nation seemed chiefly guided by the principle of promoting its own national policies, and its position in the world. . . . Each national delegation was a unit in standing for a code which should favor its national situation.⁸⁸

The formulation of balanced, practical rules also suffered from a fundamental gap between the international lawyers, who constituted the commission, and their technical (military) advisers. As Admiral Rodgers observed,⁸⁹

The majority of commissioners had little or no technical acquaintance

with the art and practice of war. Some seemed inclined to believe that the course of war, even when great national emotions were aroused, might be guided by the phrases of a code of rules previously agreed upon. They did not appear always to realize that at any time the code of accepted rules of warfare is based almost entirely on past experience and that when a new war arises, new social, economic, and belligerent conditions will make the existing code more or less unsuitable to meet the exigencies of the situation as developed in the course of the current war.

As the 1923 Hague Air Rules never were adopted by any nation, they were an immediate and total failure. This occurred in part because of a scepticism towards the law of war that existed during the inter-war period,⁹⁰ but in the main because international lawyers endeavoured to draft a set of rules that were totally at odds with state practice, technological advances and military thinking.⁹¹

If it is possible to summarise the law of war as it existed at that time, it could be reduced to two principles: (a) that the indiscriminate (that is, intentional) attack on the civilian population as such was prohibited, but that (b) a legitimate military objective could be attacked wherever located so long as ordinary care was exercised in its attack, that is, that collateral civilian casualties were not the concern of the attacker but, by state practice, were regarded as an inevitable consequence of bombardment and a legitimate way to destroy an enemy's will to resist. The historic distinction of non-combatant immunity had been tied to the range of artillery; anything within artillery range was regarded as part of the battlefield and at risk. The battlefield was extended by the industrialisation of nation-states and by a capacity for attacks on military objects beyond artillery range. The Hague Air Rules of 1923 attempted to stem this tide in the following ways:

(a) *Prohibiting 'terrorisation'*. In the practice of land and naval warfare, destruction of civilian objects was regarded as lawful as psychological means for impressing upon an enemy nation the prudence of surrender. While a line between the attack on morale and terrorisation existed – the former being ancillary, the latter intentional – the principal distinction lay in military efficiency; it would be inefficient to shell or bomb merely to terrorise, but an attack on morale ancillary to the bombardment of military targets was efficient, lawful and an accepted practice.

Article 22 was perceived as limiting this practice with respect to airplanes, but not for land artillery or naval bombardment. Such a proposal doubtless was viewed at the time not only as a constraint on air operations, but by land and naval warfare authorities as a dangerous precedent for their operations.

(b) *Limiting the range of attack.* While article 24(4) applied to bombing the same degree of permissibility for widespread destruction given land bombardment, effective use of aircraft was limited by this article to the range of artillery – or certainly its meaning was perceived that way.⁹²

(c) *'Military objective'.* There is no dispute that the purpose of all bombardment, whether ground, naval, or air, was and remains to attack military objectives. Articles 24(1) and (2) were potentially troubling for several reasons:

(1) For the first time, article 24(1) impressed upon an attacker an obligation for concern for collateral civilian casualties in attacks on individual targets. However praiseworthy this may appear in today's peacetime environment, this was a 180-degree change of course in bombardment philosophy up to that time. Again, while it applied only to aerial bombardment, it could not have escaped notice as a precedent by land and naval authorities.

(2) The term 'military objective' used in article 24(1) was undefined. As Webster and Frankland correctly noted,⁹³

Part of the argument centered upon the difference between 'military' and 'civilian' targets and developed somewhat along the lines of the conventions which had been attached to military and naval warfare. There was a school of thought which demanded that bombing should be restricted to 'military targets' which could be destroyed without undue risk to 'civilian' life or property. This argument turned upon what was meant by the term 'military target.' Clearly, a tank on the battlefield was a military target, but was a tank on the assembly line in a factory a civilian target? Clearly a soldier in the front line was a military target, but was a worker engaged in the manufacture of his rifle a civilian target? There was also the question of what constituted 'undue risk' to civilian life and property. A battleship at sea, it might be assumed, would be manned only by naval personnel and a badly aimed bomb would be unlikely to fall anywhere other than in the water. But the same battleship in port might have civilian workers on board and a badly aimed bomb might destroy anything from a warehouse to a church.

Obviously a strict interpretation of these obscure questions meant the absolute prohibition of strategic bombing and the confinement of all operations to the actual area of land fighting or to war ships at sea

In modern war between major powers there is, after all, practically nothing worth attacking which does not have some bearing upon the national war effort.

This attempt at limitation on the attack of 'military objectives' (or targets, a term regarded as synonymous) must be viewed through the eyes of air-power planners of the time. Writing five years after the 1923 Hague conference, Air Marshal Trenchard commented:⁹⁴

To attack the armed forces is . . . to attack the enemy at his strongest point. On the other hand, by attacking the sources from which these armed forces are maintained infinitely more effect is obtained. In the course of a day's attack upon the aerodromes of the enemy perhaps 50 aeroplanes could be destroyed; whereas a modern industrial state will produce 100 in a day - production will far more than replace any destruction we can hope to do in the forward zone. On the other hand, by attacking the enemy's factories, then output is reduced by a much greater proportion

[Military] objectives will, naturally, differ from time to time, and their relative importance can only be measured by the influence they happen to be exerting at any given moment. For instance, when an enemy is concentrating for an attack, the dislocation of his railways and other means of communication may produce results which will influence the course of the war far more than will the bombardment of some of his munition factories

Air Marshal Trenchard's argument was consistent with the law of war as it existed, in that it emphasised the efficient use of military force. It also illustrated the dynamic nature of targeting, as the value of a potential military objective may vary depending upon the circumstances ruling at the time. But Trenchard was to accomplish what the negotiators at the Hague failed to do - by defining 'military objectives':⁹⁵ ' . . . are any objectives which will contribute effectively towards the destruction of the enemy's means of resistance and the lowering of his determination to fight'. Trenchard and others, whether military officers or international lawyers, understood these deficiencies in the Hague Air Rules, and for that reason condemnation of the rules was virtually unanimous.⁹⁶

(3) The limited nature of the list of military objectives contained in article 24(2) was inconsistent with the practice of nations as well as with military thinking. James Molony Spaight, a member of the British delegation to the 1922-3 Hague conference and an employee of the Air Ministry, illustrated the deficiency of the list in his 1924 book, *Air Power and War Rights*, where he provided a three-page list of targets attacked during the First World War – such as an aqueduct, blast furnaces, electric works, gas works, ironworks and foundries, magneto works, motor works, steelworks, and petroleum, oil, and lubricant production, manufacturing, and storage facilities – that would be excluded from attack by article 24(2).⁹⁷ One need only carry out a quick mental review of targets attacked by all parties during the Second World War (or regarded as lawful today) to see the shortcomings of the list contained in article 24(2).

(4) 'Civilians' and 'combatants'. Article 24(2) further limited attack to 'military forces', thereby turning a blind eye to the important role played by civilians directly supporting a nation's war effort. This insistence upon maintenance of an obsolete distinction did not escape criticism by international lawyers of that era, and further contributed to the demise of the 1923 Hague Air Rules.⁹⁸

(d) *Risk of collateral civilian casualties*. Article 24(3), in prohibiting attack on the targets listed in article 24(2) if 'indiscriminate bombardment' (another undefined term) could not be avoided, was a substantial shift in responsibility for avoidance of collateral civilian casualties from the defender and the 'civilian' (however that term may be defined) to the attacker. Thus bombing of military objectives beyond the tactical battlefield became dependent upon effect or result rather than intent. Two historical examples illustrate the difficulty of such a rule:

(1) During the 1864 Union siege of Atlanta, General J. B. Hood, commanding general of the Confederate forces defending Atlanta, wrote to Union General W. T. Sherman to condemn shelling that resulted in civilian casualties. Sherman replied, condemning Hood for his failure to evacuate the civilians from Atlanta while placing his defences 'on a line so close to town that every cannon-shot and many musket-shots from our line of investment, that overshot its mark, went into the habitations of women and children'.⁹⁹

(2) As noted by one critic,¹⁰⁰ during the First World War 'Two British [aeroplanes] were out to raid Brussels They came in sight of a Zeppelin and brought it down. The debris fell

upon a convent near Ghent, and killed three nuns. Such are the consequences of war . . .'. There are at least two difficulties with the rule set forth in article 24(3). The first is that it placed a burden to avoid indiscriminate attack upon an attacker, even though the means that might lead to an 'indiscriminate' attack were not within his exclusive control. The second concerns the potential for assessment of an attack based upon results rather than intent – a concept seriously flawed, as one critic observed at that time.¹⁰¹

The question is a question of accuracy and not a question of intent. No belligerent should be required to forfeit the normal percentage of hits which might be expected on his target, simply because there will be a percentage of 'misses.' The percentage of 'hits' is a military calculation. By his effective five per cent he may destroy his 'military objective' wherever the other nine-five per cent may go. By it he may be able to win the war. It is not a question of an intention to hit civilians instead of military depots, or of an intention to terrorize generally. Like the actuary figuring expectant mortality for a life insurance company, he cannot foretell what will happen in any individual case, but he can tell what his average will be. His intent is to place 'the maximum number of hits' on his target according to his average accuracy.

But the potential difficulty of this concept was perhaps best explained by Air Marshal Trenchard.¹⁰²

As regards the question of legality, no authority would contend it is unlawful to bomb military objectives, wherever situated Such objectives may be situated in centres of population in which their destruction from the Air will result in casualties also to the neighbouring civilian population, in the same way as the long-range bombardment of a defended coastal town by a naval force results also in the incidental destruction of civilian life and property. The fact that air attack may have that result is no reason for regarding the bombing as illegitimate provided all reasonable care is taken to confine the scope of the bombing to the military objective. Otherwise a belligerent would be able to secure complete immunity for his war manufactures and depots merely by locating them in a large city, which would, in effect, become neutral territory – a position which the opposing belligerent would never accept.

The 1923 Hague Air Rules suffered an ignominious death, doomed from the outset by language that established rules for

black-and-white situations in a combat environment permeated by shades of grey. While Japan and the United States expressed some support for their adoption, the European nations were more cautious, owing to their distrust of and proximity to one another. As aircraft capabilities grew, national security concerns increased. The launching of the US aircraft-carrier *Lexington* in 1925 changed the marginal support for the 1923 Hague Air Rules by the United States to non-support, as the big ship caught the public's fancy and, with it, increased interest in the importance of aviation to national security.¹⁰³ Rapidly the 1923 Hague Air Rules drifted into obscurity, adopted by no nation, and completely ignored by most aviation historians.¹⁰⁴

The 1923 Hague Air Rules were the first, last, and only effort at the regulation of aerial bombardment before the Second World War. Nations expressed interest in forms of restraint on other occasions, most associated with the Geneva Disarmament Conference, and all illusory if not contrived. The details of this busy but legislatively unproductive period are provided elsewhere, and will not be elaborated here.¹⁰⁵ Writing on the eve of the Second World War and sixteen years after his participation in the conference that produced the 1923 Hague Air Rules, Vice Admiral W. L. Rodgers concluded:¹⁰⁶

The extensive use of airplanes in bombing cities and noncombatants is not likely to be controlled by pre-war agreements. In former times centers of industry and accumulations of supplies were small, and being scattered in many places, most of them were inaccessible to the enemy. Now they are larger and more concentrated and everywhere accessible to airplane attack. In many cases they will be worth attacking and will suffer because their destruction will tend to end the war. The incidental presence of property and noncombatants will confer no immunity on property capable of aiding the national resistance.

Last-Ditch Efforts

As the war clouds over Europe darkened, and with the experience of the wars in China, Spain and Ethiopia in mind, there were several last-ditch efforts to establish bombing standards. During debate in the House of Commons on 21 June 1938, British Prime Minister Neville Chamberlain suggested three basic rules for bombing:¹⁰⁷

1. It is against international law to bomb civilians as such and to make deliberate attacks upon civilian populations.
2. Targets which are aimed at from the air must be legitimate military objectives and must be capable of identification.
3. Reasonable care must be taken in attacking those military objectives so that by carelessness a civilian population in the neighbourhood is not bombed.

Although these 'rules' contain a number of flaws,¹⁰⁸ they were adopted by a non-binding League of Nations resolution on 30 September 1938.¹⁰⁹

On the commencement of general hostilities on 1 September 1939, President Franklin D. Roosevelt sent the following message to the warring nations:¹¹⁰ 'I am . . . addressing this urgent brief to every government which may be engaged in hostilities publicly to affirm its determination that its armed forces shall in no event, and under no circumstances, undertake the bombardment from the air of civilian populations or of unfortified cities.' Although most nations responded favourably,¹¹¹ an affirmative response to such a plea is not a legally binding act; neither the Chamberlain/League of Nations 'rules' nor the Roosevelt pledge were to have any effect on the conduct of the aerial bombing campaigns of the Second World War. Klaus Maier provides a succinct summary for the inter-war legislative process:¹¹² 'Attempts to limit air war by international agreement failed, because the conflicting national interests and divergent concepts for the use of air power could not be reconciled.'

Determining the Law: Other Sources

There are other ways for determining what the law of war relating to aerial bombardment was during the Second World War. Each will be addressed briefly.

Court decisions. In 1927, a Greco-German Mixed Arbitral Tribunal constituted in accordance with the Versailles peace treaty considered a claim against Germany for compensation on account of damage suffered as the result of the aerial bombing of Salonika by German aircraft in January 1916. As a result of the bombing, non-military goods belonging to the plaintiff were destroyed. Judgement was rendered in favour of the plaintiff on the basis that German authorities failed to provide warning of the impending attack, as required by article 26 of Hague

Convention IV of 1907. But for the failure to warn, the German attack would have been lawful, and the collateral damage to plaintiff's goods would have been a consequence of war, for which the plaintiff could not have recovered damages. The case is of little value in determination of the issue before us.¹¹³

It is at this point that I must make one exception to my stated policy of determining the law as it appeared to be prior to and during the Second World War, in order to take advantage of a post-Second World War action by the Allies. Although Professor Telford Taylor has intimated that the 1940 Luftwaffe attacks on Britain were illegal,¹¹⁴ this was not the position he took as the Chief Counsel for War Crimes at the Nuremberg War Crimes Trials. In his final report, the then Brigadier General Taylor observed:¹¹⁵

In the course of preparing the indictment for the first Nuernberg trial, it became apparent that . . . 'combat crimes' would prove of considerably less importance . . . Many of the provisions of the Hague Conventions [of 1907] regarding unlawful means of combat . . . were antiquarian. Others had been observed only partially during the First World War and almost completely disregarded during the Second World War . . . If the first badly bombed cities - Warsaw, Rotterdam, Belgrade, and London - suffered at the hands of the Germans and not the Allies, nonetheless the ruins of German and Japanese cities were the results not of reprisal but of deliberate policy, and bore witness that aerial bombardment of cities and factories has become a recognized part of modern warfare as carried on by all nations.

The indictment in the first Nuernberg trial, accordingly, contained no charges against the defendants arising out of their conduct of the war in the air.

Although the Charter of the Nuremberg International Military Tribunal listed 'indiscriminate bombing' as a crime recognisable by the Tribunal, in practice the United Nations War Crimes Commission routinely rejected cases alleging indiscriminate bombing if the bombarded towns or cities contained military objectives.¹¹⁶

Law-of-War manuals. Another way of determining the law of war at a particular period of time - such as in the decade immediately preceding the Second World War - is to look at the law-of-war manuals of the military services of the nations involved in that conflict. While military law-of-war manuals are not regarded as policy statements binding upon a nation and its

military forces, they are at least an indication of a nation's probable interpretation of the law of war. Were an air-staff planner to wonder if the plans he was writing were consistent with the law of war, in all likelihood he would go to his service law-of-war manual. A review of available materials for the period provides the following information:

United States. The principal law-of-war manual for operations on or over land was US Army Field Manual 27-10, *Rules of Land Warfare*. There were two editions available to planners: the 1914 edition (updated to 1917) and the 1940 edition. Other than defining what constituted a 'defended place', neither manual provided much information beyond that actually contained in Hague IV of 1907. Guidance to members of the US Army Air Corps preparing the various war plans, then, would have been minimal at best.¹¹⁷

In May 1941 the US Navy issued *Tentative Instructions for the Navy of the United States Governing Maritime and Aerial Warfare*. Two paragraphs provided guidance to the reader who consulted the manual:

229. Aerial bombardment for the purpose of terrorizing the civilian population, of destroying or damaging private property not of a military character, or of injuring noncombatants is prohibited. In any bombardment every practicable precaution should be taken to avoid injury to civilians.

230. The bombardment of enemy troop concentrations, communication centers, lines of communications, military or naval establishments, depots of arms or war material, workshops, plants, and factories actually used for the manufacture of war material wherever situated is not prohibited.

United Kingdom. The Royal Air Force was a separate service, did have its own separate law manual, and also employed one of the leading experts on the law of war.¹¹⁸ Yet the preface to the second (1933) edition of the *British Manual of Air Force Law* (reprinted without change in 1939) stated: 'It has not yet been found possible to include in this volume a chapter relating to air warfare corresponding to the chapter on the law and usages of war on land in the *Manual of Military Law*.'

The *British Manual of Military Law* referred to in the preceding paragraph was revised in 1929, with amendments to January 1936. There are no separate paragraphs addressing aerial bombardment. However, in the paragraphs regarding bombardments,

assaults, and sieges, paragraph 122 states:¹¹⁹ 'No legal duty exists for the attacking force to limit bombardment to the fortifications or defended border only. On the contrary, destruction of private and public buildings by bombardment has always been, and still is, considered lawful, as it is one of the means to impress upon the local authorities the advisability of surrender.'

Italy. On 8 July 1938, the Italian Government issued its first law-of-war manual. A report¹²⁰ summarised its provisions of interest to the air planner of that time:

On its face, the law repudiates the Douhet theory by defining the conditions of valid bombardment: bombardment of 'enemy objectives' is permitted when their total or partial destruction may benefit military operations; bombardment of cities and other inhabited areas is permitted when there exists a 'reasonable presumption' that they harbour military preparations or supplies; but bombardment 'for the sole purpose of punishing civil populations or of destroying or damaging properties of non-military importance,' is in every case prohibited.

There were dissenting voices to this language, and the report concludes: 'The almost universal affection of Italian airmen for the theory of Douhet makes it unlikely that [these articles] will be observed in a strict sense. In this affection they have been joined by *Il Duce*.'

Another secondary source for determination of the law is the writing of recognised experts on international law. While the writings of a number of international lawyers (and non-lawyers as well) have been cited in these pages for specific points, only two individuals stand out as authorities in the period prior to the Second World War. Interestingly enough, neither was a lawyer.

The first, James Molony Spaight, has been described previously. His first law-of-war text, *War Rights on Land*, was published in 1911; his last was the third edition of his *Air Power and War Rights*, published in 1947. Spaight excelled as a writer on the law of war, as he paid close attention to the other primary source of international law: history, or the practice of nations. Each of his three editions of *Air Power and War Rights* is worthy of close scrutiny. I have limited my consideration to the second edition, published in 1933, as it reflects Spaight's thinking closest in time to the Second World War; had air planners

sought to consult a standard work, it would have been Spaight's second edition. Spaight broadens the list of military objectives contained in the unadopted 1923 Hague Air Rules, as he did in his first edition,¹²¹ acknowledges that a legitimate target may be attacked wherever located,¹²² but concludes:¹²³ 'If a military objective is situated in such a densely populated neighborhood, or if the circumstances of the case are otherwise such that any attack upon it from the air is likely to involve a disastrous loss of non-combatant life, aircraft are bound to abstain from bombardment.'

But then Spaight qualifies this conclusion in two ways, first by noting the quasi-military nature of men and women in munitions factories. He cites other legal authorities who acknowledge that these persons may be regarded as auxiliary services of the armies while at work, but notes a split of opinion as to whether they may be attacked at home.¹²⁴ As to bombing of civilian property, after recognising the historical practice that permitted general devastation, and the limitation contained in Hague IV of 1907 regarding a connection between intentional destruction and military necessity, he ties destruction of civilian property to military utility (that is, efficiency) and the degree of risk to innocent civilians – again, the concept of 'disastrous loss of non-combatant life' noted above.¹²⁵ While recognising the impact of anti-aircraft fire and weather on bombing operations,¹²⁶ Spaight errs in assuming that night bombing would be more accurate.¹²⁷ Beyond the concepts noted in this paragraph, Spaight reached no conclusions.

The second recognised authority is M. W. Royse,¹²⁸ whose *Aerial Bombardment and the International Regulation of Warfare* was published in 1928.¹²⁹ Like Spaight, Royse was a pragmatist; while he relied upon the historical practice of nations for precedent, he also brought combat-aviation experience into his analysis and writing. In examining the general history of bombardment, for example, Royse cuts to the central point:¹³⁰ 'The history of bombardment regulation shows a distinct utilitarian development, in which the idea of military effectiveness dominates, and in which the doctrines of permissible violence and social sanction are of secondary importance as checks or influences.'

After examining the history of the modern law of war up to and including the 1923 Hague Air Rules, Royse concludes:¹³¹

There are thus no conventional rules in actual force which directly

affect aerial bombardment. At the present time the only restrictions bearing on such operations are those general and rather vague limitations known as the customary practices of war

It cannot reasonably be affirmed to-day that it is wrongful or illegal to bombard a military objective, fairly regarded as such, by all available means of attack; nor does a military objective lose that character merely because it is situated in the midst of a crowded city remote from the immediate zone of land operations. Military objectives are likely to be hunted down and attacked, and the fact that the incidental harm may fall upon non-combatants and that the incidental destruction of property may at times approximate devastation probably will be accepted, as heretofore, as an unavoidable incident of warfare. The problem of regulation and its discussion will, as heretofore, hinge upon the question of what may properly be regarded as a military objective, and the question of the military importance of its destruction, viewed in relation to its situation and the probable effects of an attack upon it. In other words, the test in the future, as in the past, will be purely utilitarian.

Participating in a conference of experts held by the International Committee of the Red Cross in 1930,¹³² Royse offered a number of points that summarise the law as it seems to have existed in the decade preceding the Second World War as well as during the period of that conflict:

- The civilian population is not totally immune from the effects of bombardment, whether land, naval or air; indeed, the rules and practices of warfare do not protect civil populations against incidental bombardment even when such bombardment means wholesale destruction of property and civilian life.
- The extent to which civil populations are legally protected against bombardment has never been precisely determined; there is no agreement among jurists as to the extent of violence on the plea of military necessity.
- The law of war is based upon the practice of nations. In that regard, during First World War demoralisation of the enemy by means of widespread bombardment was accepted by the military services as part of the functions of the aviation bombardment groups, as it was for artillery.
- To base the legitimacy of a means of warfare upon the extent of its incidental damage to civil populations would be a distinct innovation in the regulation of warfare on land.
- To interpret indiscriminate bombardment on the basis of in-

cidental damage to non-combatant populations would thus, in effect, legitimise aerial bombardment, since the permissible objectives would almost invariably be found surrounded by civil populations.

— At no time has the effective operation of vital weapons been limited by international regulations. It is therefore hardly likely that air power will be so restricted.¹³³

In every respect, Royse was proved right.

In summary, an air planner in any nation in the inter-war era as well as during the Second World War would have had a difficult time determining the law governing aerial bombardment. He would have found it impossible to find clear, well-defined, express language prohibiting the actions he was contemplating; at best, he would have found considerable disagreement and confusion among scholars. He would have been unable to find a comprehensive list of objectives that legitimately could be considered military objectives; and, in particular, he would not have been able to find appropriate language explaining the distinction between combatants and non-combatants in contemporary terms. While these may be attributable to a failure of diplomacy, it is my opinion that the last must be laid directly at the feet of international lawyers and moral philosophers, who failed to adjust international law and moral thinking to major technological changes in society and warfare. International Law Professor Philip C. Jessup warned in 1941 of the danger of such torpidity in the development of the law relating to bombing, noting presciently that the 'law often lags behind facts, but if it does not correspond to facts it is eventually nullified or modified'.¹³⁴ Such was the fate that befell the law of war relating to aerial bombardment during the Second World War.

Conclusion

When I was a boy, I went to see one of our post-season football bowl games. This game pitted an individual who had been selected as the best running back in college football against a nationally-recognised defensive player. In the second half the two met in a bone-jarring collision that could be heard above the roar of the 60,000 fans. As the two players were carried, unconscious, from the playing-field, the announcer declared that 'This

was a case of the unstoppable force meeting the immovable object.' In the Second World War, there was a similar collision between the bombing doctrine and tactics of all nations and the basic humanitarian concept of discrimination – and the innocent civilian suffered as a result.

How did this happen? The preceding pages have suggested some problems. Warfare underwent revolutionary changes in the twentieth century to which the law of war has yet to adjust. Speaking of the submarine, aeroplane, and nuclear weapons, international lawyer Julius Stone summarised the predicament.¹³⁵

A factor in the weakness of modern war-law springs from rapid technological development in new and transformed weapons . . . , [which] doubly depress the role of law. On the one hand they outmode existing rules, on the other, when the new weapons are wholly new, like the airplane or the atom bomb, the problem of regulation finds the rudimentary organs of international legislation at their most impotent. The weapons come into use in a kind of legal vacuum. The more destructive they are, the stronger is the pressure of public opinion in most countries to limit or even outlaw them. But also, the more effective they are, the more rarely can legislation by agreement be achieved, so long as only one State or block of States thinks it has or may get a decisive lead in the weapon.

Thus occurred the legal vacuum that existed throughout the Second World War. Of course, the vacuum was not total. All nations agreed for humanitarian and utilitarian purposes that indiscriminate bombardment – whether by land, naval or air forces – was prohibited. But the acknowledged and apparently accepted philosophy of discrimination was qualified by the following:

- A long-standing practice of nations that collateral civilian casualties were not only an inevitable result of bombardment, but the cost of a nation's engaging in war – and their avoidance the principal responsibility of the defender, who had exclusive control over the civilian population.

- An equally long-standing principle that collateral civilian casualties as a result either of general bombardment or inaccurate bombardment were a way in which the morale of an enemy nation could be affected, legally.

- Discrimination was the sole standard in law and the ethics of war. Against that vague, undefined standard were legal/moral arguments that:

- Efficient brutality in war deterred war or hastened the conclusion of hostilities; and

- A more brutal campaign could and should be waged against an unjust or immoral opponent.

Neither of these counterarguments had been rejected by the law of war at the outset of the Second World War. There has been some qualification of the first since the Second World War in the 'limited war' theory articulated within some Western democracies, but then again none of those nations has been confronted with a threat equal to that experienced during the Second World War. The limited-war theory has not been accepted by the non-Western World, as illustrated by actions by both sides in the Iran-Iraq War and Soviet operations in Afghanistan.¹³⁶ The second counterargument remains a valid moral argument, and is a fundamental concept overriding the law of war in many non-Christian nations, as well in Socialist military doctrine.¹³⁷ Neither counterargument can be brushed aside easily.

- The principle of discrimination was at the time of the Second World War - and remains today - conditioned by:

- the commingling of military objectives with the civilian population;

- a fundamental failure of the law of war to acknowledge that the traditional distinction between the combatant and non-combatant was obsolete, and had been for the century preceding the Second World War; and

- legitimate actions taken by the defender - such as dispersion of war materials and/or production facilities, camouflage or other ruses, and air defences - which could result and are intended to result in a bombing force being less precise, thereby placing the defender's civilian population at greater risk.

This last point is quite important, but generally is neglected in evaluating a bombing mission or campaign, or actions taken by an attacker to compensate for the defender's efforts. For example, each major bombing campaign during the Second World War found the attacker forced to resort to the cover of darkness in order to minimise the effectiveness of enemy defences, with a concomitant decrease in bombing accuracy.

In this regard something must be said about 'indiscriminate' bombing, as I believe that the term has been used rather promiscuously by many historians, international lawyers, and other writers. The term 'indiscriminate' is without legal definition; a standard dictionary definition is 'not marked by discrimination;

not marked by careful distinction'.¹³⁸ Unfortunately, such a definition contributes little to answering the question as to whether or not the law regarding discrimination was followed by bomber forces during the Second World War. I would offer three observations, however:

- In considering 'careful distinction', the standard was one of ordinary care by a reasonable man under the same or similar circumstances. No greater standard of care has been proposed in the years that have passed since the Second World War.

- In the race to condemn aerial bombardment, many have failed to take into proper account the effect of a defender's actions. If a bomb is dropped and misses the target, then the bomber is guilty of 'indiscriminate' bombing. This is an untenable position even by today's bombing standards. It holds the Second World War bomber crews to a higher standard of bombing accuracy than is justified by the facts, and holds aerial bombardment to a higher standard than artillery or naval gunfire, but in particular fails to take into account intervening actions by a defender that prevent – and are intended to prevent – a bomber from bombing as accurately as possible.¹³⁹

Did indiscriminate bombing occur during the Second World War? Of course, and each major participant was guilty of it at one time or another. The fundamental distinction between bombing forces was one of capability more than intent. I agree with the conclusion of Royse that the general measure of discrimination is tied to military utility or effectiveness, that is, that bomber forces should bomb as accurately as possible given their capabilities and opposition. I believe bomber forces during the Second World War generally endeavoured to perform their respective missions at a level that made the most effective utilisation of their capabilities, subject to conditions over the target (enemy defences, wind, weather). Certainly there are exceptions. Allied bomber forces utilised a greater standard of care in an effort to minimise civilian casualties in Nazi-occupied nations than they did in their attacks on targets in Germany. But attempts by some critics to set a time during the war at which bombing forces could have become more discriminate are open to challenge.¹⁴⁰

- In this regard, even if more precise standards were to have existed during the Second World War, the law of war is not a suicide pact. It does not require that an attacker employ the most discriminate force available to him. Were that the case, RAF Bomber Command (for example) would have been obliged

to fly precision-bombing missions exclusively once it demonstrated its capability to do so with the 1943 dams raids by No. 617 Squadron,¹⁴¹ or a nation would be required to sacrifice commando units rather than employ bomber aircraft in attacks on military objectives where there is a risk of collateral civilian casualties. No such obligation exists in the law of war.

It has been my privilege to have been chosen to address this highly contentious issue among so many distinguished historians. I suspect I was invited in the anticipation that I would render the great judicial decision as to the legality of Second World War aerial bombardment that much wiser men specifically declined at Nuremberg after that war. I do not presume to be the fool who rushes in where wise men have feared to tread. What I have done is offer to you the dilemma with which men and nations struggled for almost half a century prior to the Second World War – that of establishing legal parameters for the employment of new engines of war that would not hinder their effectiveness, while offering some degree of protection to innocent civilians. Regrettably, they were unsuccessful; perhaps their mission was an impossible one. I have endeavoured to illustrate that the issues are not as clear as some would like to make them, while offering some factors that should be considered in evaluating historical performance. Ultimately, however, it is up to you, the historians of that era, to serve as the triers of fact. That is your responsibility, and it is with that charge that I leave you.

Notes

1. Estimates of German deaths vary. The *US Strategic Bombing Survey (Summary Report [European War])*, p. 15) estimated that 205,000 civilians were killed by Allied bombing between 1 January 1941 and 31 January 1945. Hans Rumpf, in *The Bombing of Germany*, New York, 1962, p. 164, places the figure at 630,000. David Irving, in *The Destruction of Dresden*, New York, 1963, p. 41, sets the number of civilian deaths at 650,000. However, Irving originally estimated civilian deaths resulting from the February 1945 Allied air raids on that city at 'more than 135,000' (*The Destruction of Dresden*, pp. 9, 159). Subsequently, in a letter to *The Times* (London), 7 July 1966, p. 13, he reduced the total to 25,000. But later historians continue to cite Irving's original figure in arriving at their own conclusions as to total civilian

deaths. See, for example, Larry J. Bidinian, *The Combined Allied Bombing Offensive Against the German Civilian 1942-1945*, Lawrence, Kansas, 1976, pp. 37, 51, 242; and George H. Quester, *Deterrence Before Hiroshima*, New York, 1966, p. 150 (the error remained, uncorrected, in a 1986 edition). Civilians killed in Great Britain have been accounted for as follows:

Bombing	51,509
Flying bombs	6,184
Rockets	2,754
Cross-channel guns	148

(Basil Collier, *The Defence of the United Kingdom*, London, 1957, p. 528).

From a law-of-war standpoint, there is a potential for discrepancy in these figures. Civilian workers killed within a legitimate target, such as a military base, munitions plant, or aircraft engine manufacturing plant, are not regarded as 'civilian casualties'. While this should not be construed so broadly as to include all civilians in an industrial city, as occurred during the Second World War, obviously reasonable persons could arrive at different numbers. Disagreement would have only a fractional impact on the total numbers. The US Strategic Bombing Survey (*The Effects of Bombing on Health and Medical Services in Japan*, p. 5) notes that the majority of civilian casualties in Germany and Japan were women and children. See also Fred Charles Ikle, *The Social Impact of Bomb Destruction*, Norman, Oklahoma, 1958, p. 205.

The 4th (1955) edition of *Deutschland heute* (p. 156), official statistical publication of the Federal Republic of Germany, provided the following figures:

Losses among German civilians through hostile action:	500,000 dead
Losses among German civilians from the eastern provinces:	1,500,000 dead

See also Martin K. Sorge, *The Other Price of Hitler's War*, New York, 1986, p. 67.

Obviously not all civilian casualties can be attributed to bombing. The devastation of Berlin by Russian artillery bombardment was so great that the US Strategic Bombing Survey could perform no evaluation of the damage done to that city by the allied strategic air offensive. Total German civilian casualties have been placed at 1.5 million (Earl F. Ziemke, *Stalingrad to Berlin: The German Defeat in the East*, Washington, 1968, p. 500), in close agreement with the *Deutschland heute* figure cited above. Hence the allied strategic air offensive accounted for 20 per cent to 40 per cent of the civilian losses in Germany, a significant perspective for this conference. It is important to note that it was not the major cause of death, in Germany or elsewhere. In Russia, where strategic (rather than tactical) air-power played an insignificant role, Russian civilian and military losses have been listed as 22 million, of which 10.15 were civilians. While the very high military losses can be attributed to a number of factors, including inefficient military medical services, high civilian and military losses are directly attributable to Soviet tactics, which throughout the war tended to be

- extravagant in terms of Soviet lives. Ziemke, *Stalingrad to Berlin*, p. 500, n. 1.
2. Norman Longmate, *Air Raid: The Bombing of Coventry*, London and New York, 1976, facing p. 238.
3. The attacks on Cologne are described in Ralph Barker, *The Thousand Plan*, London, 1965; Eric Taylor, *Tausend Bomber auf Köln*, Düsseldorf, 1979; Ranke, August Sander, *Die Zerstörung Kölns*, Mosel, 1945; and Eric Taylor, *Operation Millenium*, London, 1987. Again, a certain perspective is appropriate. During the allied strategic air offensive, Cologne cathedral was struck by fourteen bombs. It is estimated that post-war damage by air pollution, principally automobile exhaust emissions, has caused substantially greater damage. German tour guide to author during visit to Cologne cathedral, October 1986.
4. Sir Arthur Harris, *Bomber Offensive*, London, 1947, p. 177. Lest this be dismissed as the cynicism of a non-lawyer, it should be noted that Sir Hersch Lauterpacht, one of the pre-eminent international lawyers of this century (and author of the post-war British manual on the law of war), once opined: 'If international law is the weakest point of all law, then the law of war is virtually its vanishing point.' For a general historical survey of the law of war relating to aerial bombardment, see W. Hays Parks, 'Conventional Aerial Bombing and the Law of War', *US Naval Institute Proceedings (Naval Review)* 108, 5, May 1982, pp. 98-115.
5. *Trial of Major War Criminals Before the Nuernberg Military Tribunals Under Control Council Law No. 10*, Nuernberg, October 1946-April 1949, Vol. XI, Washington 1950, p. 759.
6. *Ibid.*, pp. 1296-7. Or, as R. J. Overy says in his preface to *The Air War 1939-1945*, London, 1980, pp. xi-xii: 'I have concentrated . . . on trying to establish the historical context within which such decisions were made . . . This account is not about the history of post-war recrimination. It is about the war as it was understood, however imperfectly or unethically, at the time.'
7. See, for example, Max Hastings, *Bomber Command*, London, 1979; and Geoffrey Best, *Humanity in Warfare*, London, 1980, pp. 279-84. With regard to the latter, about which more will be said later, this is a small flaw in a book that otherwise offers a superb treatment of the history of the modern law of war.
8. Dudley Saward, *'Bomber' Harris*, London, 1984; and cf. Charles Messenger, *'Bomber' Harris and the Strategic Bombing Offensive, 1939-1945*, London, 1984.
9. New Haven, 1987, pp. 33-8.
10. New York, 1985. See also Barrie Paskins and Michael Dockrill, *The Ethics of War*, Minneapolis, 1979, pp. 1-57; and W. V. O'Brien, *The Conduct of Just and Limited War*, New York, 1981, p. 121.
11. See R. S. Hartigan, *The Forgotten Victim: A History of the Civilian*, Chicago, 1982; R. C. Smail, *Crusading Warfare, 1097-1193*, Cambridge, 1956; B. W. Tuchman, *A Distant Mirror*, New York, 1978; and Philippe Contamine, *War in the Middle Ages*, Oxford, 1984.
12. See, generally, Michael Howard, *War in European History*, New York, 1976; idem, 'Temperamenta Belli: Can War Be Controlled?', in idem (ed.), *Restraints on War*, (Oxford, 1979), pp. 1-16; Best, *Humanity*; O'Brien, *Conduct of Just and Limited War*; and J. T. Johnson, *Just War Tradition and the Restraint of War*, Princeton, 1981.

13. Johnson, *Just War Tradition*, pp. 196-8, 200, 222-3.
14. Michael Walzer, *Just and Unjust Wars: A Moral Argument with Historical Illustrations* (New York, 1977), p. 253; Johnson, *Just War Tradition*, p. 223; and Sir Robert H. M. S. Sandby, 'The Ethics of Bombing', *Air Force and Space Digest*, 50, No. 6 (June 1967), pp. 48-53. Some confusion exists today with respect to *discrimination* and this latter concept owing to the attempted injection of a concept of *proportionality* into the law of war. Historically proportion, in its *jus in bello* sense of matching force against force, is defined in relative terms. Discrimination was of a higher moral priority than proportionality. Johnson, *Just War Tradition*, p. 196. While the concept of proportionality has been urged by some international lawyers, it also has been adopted by some contemporary utilitarian moral philosophers, connecting it (in Johnson's words) 'to that of the greatest good for the greatest number'. Johnson, *Just War Tradition*, p. 228.

While proponents offer the classic example of disproportionate use of force as evidenced by the destruction of a village of five hundred in order to kill a single sniper, they falter in further explanation of the concept. Western nations and the International Committee of the Red Cross sought to codify the concept of proportionality at the Diplomatic Conference on the Reaffirmation and Development of International Humanitarian Law Applicable in Armed Conflicts, held in Geneva from 1974 to 1977. The concept was categorically rejected by the Socialist bloc. Ultimately language was drafted in article 51(5)(b) of Protocol I that enables the Western nations to claim the concept is codified therein, while permitting the Socialist nations to deny the same; yet its violation is made a war crime in article 85. The language is so general and subject to contradictory views that under US domestic law it would be Constitutionally void for vagueness. As one pundit noted, 'Only international lawyers would make something a crime they couldn't define.' For this and a number of other reasons, the United States has decided not to become a party to Additional Protocol I.

The important point in the concept of proportionality is consideration of the potential for collateral civilian casualties in the vicinity of a target, which will be discussed later in this paper. As Dr James Turner Johnson has correctly noted, however, '... the idea of collateral damage in contemporary limited war thought is a pregnant one'. Johnson, *Just War Tradition*, p. 221. What is important in the context of this symposium is that the concept was not even a gleam in its parents' eyes prior to and during the Second World War.

15. Paul Ramsey, *The Just War: Force and Political Responsibility*, New York, 1968, p. 154.
16. Or, similarly, the 1865 Union raid by Major General James H. Wilson to Columbus, Georgia, and Selma, Alabama, to attack two of the South's most productive industrial communities. See James Pickett Jones, *Yankee Blitzkrieg*, Athens, Georgia, 1976.
17. Michael Howard, *The Franco-Prussian War*, London, 1961, pp. 2-4, 22, 43, 61-2, 230.
18. R. S. Hartigan, *Lieber's Code and the Law of War*, Chicago, 1983.
19. James Brown Scott (ed.), *Instructions to the American Delegates to the Hague*

- Peace Conferences and Their Official Reports*, New York, 1916, p. 4.
20. B. W. Tuchman, *The Proud Tower*, New York, 1966, pp. 251-67; and W. R. Hawkins, 'Captain Mahan, Admiral Fisher and Arms Control at The Hague, 1899', *Naval War College Review* XXXIX, 1 (Jan.-Feb. 1986), pp. 77-91. Nations sending delegations were Austria, Belgium, Bulgaria, China, Denmark, France, Germany, Great Britain, Greece, Italy, Japan, Luxemburg, Mexico, Montenegro, The Netherlands, Persia, Portugal, Romania, Russia, Serbia, Thailand, Spain, Sweden-Norway, Switzerland, Turkey, and the United States.
 21. Hague Declaration (IV, 3) Concerning Asphyxiating Gases (29 July 1899), contained in D. Schindler and J. Toman, (eds.), *The Laws of Armed Conflict*, Geneva, 1973, pp. 99-100.
 22. Hague Declaration (V, 1) Concerning Expanding Bullets (29 July 1899), contained in D. Schindler and J. Toman, *Laws*, pp. 103-104. For an interesting account of the politics of this treaty, see J. T. Greenwood, 'The Political Factors', *Gun Digest*, 34, (34th edn, 1980), pp. 161-8. See also E. M. Spiers, 'The Use of the Dum Dum Bullet in Colonial Warfare', *The Journal of Imperial and Commonwealth History*, 4, 1975, pp. 3-14.
 23. L. B. Kennett, *A History of Strategic Bombing*, New York, 1982, pp. 1-9.
 24. R. J. Parkinson, 'Aeronautics at the Hague Conference of 1899', *The Airpower Historian*, VII, 2 (April 1960), pp. 106-111, p. 108; D. C. Watt, 'Restraints on War in the Air Before 1945', in Michael Howard (ed.), *Restraints on War*, pp. 57-77, p. 60.
 25. Thus General den Beer Poortugael, in the first consideration of the proposed ban, advised the subcommission that the government of the Netherlands supported the Russian proposal. James Brown Scott (ed.), *The Proceedings of the Hague Peace Conferences*, 3 vols. Vol. I: *The Conference of 1899*, New York, 1920, p. 341.
 26. For example, the British delegation was under instructions not to agree with any restrictions on the employment of weapons. Memorandum, War Office to Foreign Office (17 May 1899), contained in G. P. Gooch and H. Temperley (eds.), *British Documents on the Origins of the War 1898-1914*, London, 1927, p. 226. Instructions from the Secretary of State to the US delegation provided in part:

'The second, third, and fourth articles [being the proposals in Count Muraviev's memorandum, n. 19 above], relating to the non-employment of firearms, explosives, and other destructive agents, the restricted use of existing instruments of destruction, and the prohibition of certain contrivances employed in naval warfare, seem lacking in practicability, and the discussion of these propositions would probably prove provocative of divergence rather than unanimity of view. It is doubtful if wars are to be diminished by rendering them less destructive, for it is the plain lesson of history that the periods of peace have been longer protracted as the cost and destructiveness of war have increased. The expediency of restraining the inventive genius of our people in the direction of devising means of defense is by no means clear, and considering the temptations to which men and nations may be exposed in a time of conflict, it is doubtful if an international agreement to this end would prove effective. The dissent of a

single powerful nation might render it altogether nugatory. The delegates are therefore, enjoined not to give the weight of their influence to the promotion of projects the realization of which is so uncertain.' - James Brown Scott (ed.), *Instructions*, pp. 7-8.

British military reaction following the conference paralleled the American delegation instructions. Lord Wolseley, Commander-in-Chief of the British Army, wrote to the British Secretary of State on 7 October 1899, with the following comments:

'Restrictions on scientific inventions deprive a nation of the advantages which accrue from its scientific men and from the productive capacity of its manufacturing establishments

It can be proved to the hilt that scientific development of engines of destruction had tended

(a) to make nations hesitate before going to war;

(b) to reduce the percentages of losses in war;

(c) to shorten the lengths of campaigns, and thus to reduce to a minimum the sufferings endured by the inhabitants.' - Watt, *Restraints on War in the Air*, pp. 60, 61.

27. Scott, *Proceedings*, Vol. I: 1899, p. 342.

28. Captain Alfred Thayer Mahan, USN, was a member of the US delegation, and Crozier's co-delegate on Commission I. Mahan represented the US before the subcommission addressing naval warfare matters, while Crozier was the US representative before the subcommission on land warfare. Mahan was of rather firm opinion on these matters, and there appears no doubt but that Crozier was 'counselled' on his responsibilities by Mahan, who was his senior in rank, experience and knowledge of international affairs. Tuchman, *The Proud Tower*, p. 262; and Hawkins, 'Captain Mahan', p. 84.

29. Scott, *Proceedings*, Vol. I, pp. 353-4.

30. Scott, *Proceedings*, Vol. I, p. 280.

31. Hague Declaration (IV, 1) To Prohibit for the Term of Five Years the Launching of Projectiles and Explosives from Balloons, and Other New Methods of a Similar Nature (29 July 1899), contained in Schindler and Toman, *Laws*, pp. 133-6. The treaty ultimately was ratified by all nations party to the negotiations except Great Britain.

32. A. Y. K. Kuhn, 'The Beginnings of an Aerial Law', *The American Journal of International Law*, 4, 1910, p. 118.

33. Scott, *Instructions*, p. 4.

34. For example, the senior British naval representative to the conference was Vice-Admiral Sir John A. Fisher, RN, whose philosophy towards the law of war has been described as follows:

'Fisher's ideas as to war, and especially as to naval war, were all based upon those current in Nelson's time. He was a bit of a barbarian who talked like a savage at times, to the no small scandal of his colleagues at The Hague.

"The humanizing of War!" he declared. "You might as well talk of humanizing Hell! When a silly ass at The Hague got up and talked about

the amenities of civilized warfare and putting your prisoners' feet in hot water and giving them gruel, my reply, I regret to say, was considered totally unfit for publication. As if war could be civilized! If I'm in command when war breaks out I shall issue my orders:

'The essence of war is violence.'

'Moderation in war is imbecility.'

'Hit first, hit hard, and hit anywhere.'"

He [continued Stead] had the not uncommon notion . . . that nations are deterred from going to war by fear of the atrocities which accompany conflict. He exclaimed impatiently . . . "What you call my truculence is all for peace. If you rub it in, both at home and abroad, that you are ready for instant war with every unit of your strength in the first line, and intend to be first in, and hit your enemy in the belly, and kick him when he is down, and boil your prisoners in oil (if you take any), and torture his women and children, then people will keep clear of you.'" - (A. J. Marder, *The Anatomy of British Sea Power*, New York, 1976, p. 347, quoting from Sir R. H. S. Bacon, *The Life of Lord Fisher of Kilverstone*, 2 vols, London, 1929, Vol. I, pp. 120-2, 171.)

The pessimistic philosophy expressed by Fisher is mirrored in the official instructions to the British and American delegations, n. 26 above. Fisher had his predecessors in the US Army. In a letter dated 4 September 1864 to Chief of Staff of the Army General H. W. Halleck from General W. T. Sherman, Sherman observed: 'If the people raise a howl against my barbarity and cruelty, I will answer that war is war, and not popularity-seeking. If they want peace, they and their relatives must stop the war.' W. T. Sherman, *Memoirs of W. T. Sherman*, 2 vols, New York, 1891, Vol. II, p. 111.

35. See Carl von Clausewitz, *On War*, ed. and trans. Howard and Paret, Princeton, 1976, p. 75: 'Kind-hearted people might of course think there is some ingenious way to disarm or defeat an enemy without too much bloodshed, and might imagine this is the true goal of the art of war. Pleasant as it sounds, it is a fallacy that must be exposed: war is such a dangerous business that the mistakes which come from kindness are the very worst. For an excellent discussion that places Clausewitz in perspective with the modern law of war, see Howard, *War in European History*. See also Marder, *British Sea Power*, p. 76.
36. *The Command of the Air*, 1921, contained in Kohn and Harahan (eds), Washington, 1983.
37. Julius Stone, *Legal Controls of International Conflict*, New York, 1954, p. 627.
38. Contained in Schindler and Toman, *Laws* p. 57.
39. Of note is that, while articles 14 and 15 of the Lieber Code state the same principle, what the Lieber Code authorises, Hague II sets forth in a prohibitive manner. This is a manifestation of the fundamental distrust international lawyers have for things military, and a reluctance to permit battlefield commanders any latitude in situations that require a judgement call. This affects the credibility of the law of war in its implementation by the military.

40. Scott, *The Hague Peace Conferences of 1899 and 1907*, 2 vols, Baltimore, 1909, Vol. I, p. 537.
41. F. E. Quindry, 'Aerial Bombardment of Civilian and Military Objectives', *Journal of Air Law and Commerce*, II, 4, October 1931, pp. 474-509, p. 484. The term 'unfortified' was used in the draft Brussels Rules of 1874; it was changed to the broader 'undefended' in Hague II of 1899.
42. C. Cole and E. F. Cheesman, *The Air Defence of Britain 1914-1918*, London, 1984, p. 6.
43. Scott, *Proceedings*, Vol I: 1899, p. 424.
44. In many cases this confusion was the product of inadequate research, usually as a result of reading the language of the treaty only. The intent was clear: 'It is to be noticed that this article speaks of undefended, not of unfortified, towns. Only where there are no fortifications, no troops, and no open resistance by the population, does this article apply.' (W. P. Bordwell, *The Law of War Between Belligerents*, Chicago, 1908, p. 287). The US Army's law-of-war manual - which would have provided guidance to Army Air Corps planners through the Second World War - offered clarification in each of its editions (1914, 1917, 1940, 1944, and 1956). The language was further clarified in 1976 in Change 1 to Field Manual 27-10, *The Law of Land Warfare*, Washington, 1976 by addition of the following to paragraph 39:

'b. Interpretation; An undefended place, within the meaning of Article 25, HR, is any inhabited place near or in a zone where opposing armed forces are in contact which is open for occupation by an adverse party without resistance. In order to be considered as undefended, the following conditions should be fulfilled:

 - (1) Armed forces and all other combatants, as well as mobile weapons and mobile military equipment, must have been evacuated, or otherwise neutralized;
 - (2) no hostile use shall be made of fixed military installations or establishments;
 - (3) no acts of warfare shall be committed by the authorities or by the population; and,
 - (4) no activities in support of military operations shall be undertaken.'
45. Contained in Scott, *Proceedings*, Vol. II: 1907 (I), New York, 1920, p. 1.
46. Tuchman, *The Proud Tower*, pp. 277-88; Alfred Gollin, *No Longer A n l l a n d*, London, 1984, particularly Chapter IX; and C.H. Gibbs-Smith, *The Rebirth of European Aviation*, London, 1974.
47. Schindler and Toman, *Laws*, pp. 133-8.
48. Stone, *Legal Controls*, p. 623.
49. Schindler and Toman, *Laws*, p. 57. Article 27 also was amended to add historic monuments to the list of specially-protected property.
50. Schindler and Toman, *Laws* 38, pp. 591-603.
51. Committee II was responsible for the redraft of the 1899 Hague II into the 1907 Hague IV, while Committee III drafted Hague IX. That there was little or no co-ordination between the two committees is illustrated by the prefatory language in the naval bombardment treaty, which refers to the Hague II Regulations of 1899, rather than its successor (Hague IV of 1907),

then being drafted with only slight change. For additional detail on the confusion created, see Burrus M. Carnahan, 'The Law of Air Bombardment in Its Historical Context', *The Air Force Law Review*, 17, 2, 1975, pp. 39-49. The intent to melt land and naval rules dated to efforts of the Institute of International Law at Oxford in 1881 (Scott, *The Hague Peace Conferences of 1899 and 1907*, I, pp. 587-98). The US delegation to the Second Hague Peace Conference regarded Hague IX as bringing the rules of land and naval warfare into 'exact harmony'. Scott, *Instructions*, p. 172. The Institute of International Law, meeting at Madrid in 1911, concluded that 'aerial war is permitted, but on the condition of not presenting greater dangers than land or sea war for the persons or properties of the peaceful population' (John Westlake, *International Law, Part II, War*, Cambridge, 1913). While each of these statements seems to indicate the clear intent of the 1907 conferees to establish one legal regime for bombardment by land and naval forces, the conferees exacerbated the problem with the statement in the Final Act of the 1907 conference expressing the hope 'that in the programme of the next conference, and that in any case the powers may apply, as far as possible, to war by sea the principles of the convention relative to the laws and customs of war on land' (Scott, *Proceedings*, Vol. II: 1907(1), p. 289).

52. P. W. Williams, 'Legitimate Targets in Aerial Bombardment', *The American Journal of International Law*, 23, 1929, pp. 570-81, p. 572.
53. The Hague Air Rules of 1923, discussed below, though containing a list of lawful targets, were never adopted by any nation.
54. Scott, *Instructions*, Report to the Secretary of State of the United States Delegation to the Second Hague Conference, p. 112.
55. Bordwell, *The Law of War Between Belligerents*, 44, p. 287.
56. Kuhn, 'Beginnings of an Aerial Law', p. 119.
57. *Ibid.*; see also Scott, *The Hague Peace Conferences of 1899 and 1907* Baltimore, 1909, I, pp. 653-4.
58. In part, this may be the result of the fact that most international lawyers have little knowledge of military operations, doctrine and technology. For example, at the 1974-7 Geneva Diplomatic Conference, the international lawyers who were delegates went to extraordinary lengths to establish a legal regime for protection for medical aircraft operating in a combat environment, finally arriving at provisions which they hailed as a great advance in the law of war. See, for example, Waldemar A. Solf, 'Protection of Medical Aircraft', *US Army Aviation Digest*, 24, 4, April 1978, pp. 15-17; 5, May 1978, pp. 33-6; 6, June 1978, pp. 26-9; and 7, July 1978, pp. 12-19. However, the provisions are highly dependent on agreement between the parties to the conflict in the area in which an aircraft would be flying its mission, which would be virtually impossible on the modern electronic battlefield. When the principal negotiator of these provisions was asked by the author about this dilemma, he confessed that neither he nor any other Geneva negotiator ever considered the potential impact of electronic warfare on their work. He acknowledged that he knew nothing about electronic warfare.
59. Save and except for the 1923 Hague Air Rules, discussed below, no attempt was made to amend or update the 1907 Hague law-of-war treaties until

1974. If the reader considers the technological advances made in aviation, bombing and air defences in the 67-year span between the 1907 Hague Peace Conference and the Geneva Diplomatic Conference that met from 1974 to 1977 to produce the 1977 Additional Protocols I and II, or the advances that occurred from 1907 to 1945, one can appreciate how far behind technology the law of war lagged. The treaty that was to update Hague IV and IX of 1907, the 1977 Protocol I, was not successful in that endeavour. The United States and France have decided not to become a party to it. At the time of this conference, of the principal participants in the Second World War, only Italy has ratified Protocol I.
60. Scott, *The Hague Peace Conferences of 1899 and 1907*, Vol. II, Baltimore, 1909, pp. 289–90.
 61. Kennett, *Strategic Bombing*, pp. 19–20. See also J. H. Morrow, *Building German Airpower 1909–1914*, Knoxville, 1976, and Robin Higham, *The British Rigid Airship 1908–1931*, London, 1961.
 62. Among others, Sir. W. A. Raleigh and H. A. Jones, *The War in the Air*, Oxford, 1922–27; M. Maurer (ed.), *The U.S. Air Service in World War I*, Washington, 1979; S. F. Wise, *Canadian Airmen and The First World War*, Toronto, 1980; Joseph Morris, *The German Air Raids on Great Britain 1914–1918*, London, 1925, repr. 1969; G. P. Neumann, *The German Air Force in the Great War*, London, 1921, 1969; J. R. Cuneo, *Winged Mars and The Air Weapon*, Harrisburg, 1942 and 1947, respectively; Webster and Frankland, *Strategic Air Offensive I*, pp. 34–51; G. W. Haddow and P. M. Grosz, *The German Giants*, London, 1962; Douglas Robinson, *The Zeppelin in Combat*, Seattle, 1962; R. M. Fredette, *The Sky on Fire*, New York, 1966; F. K. Mason, *Battle Over Britain*, London, 1969, pp. 17–40; H. Penrose, *British Aviation: The Great War and Armistice, 1915–1919*, London, 1969; Robin Higham, *Air Power: A Concise History*, New York, 1972; N. Jones, *The Origins of Strategic Bombing*, London, 1973; B. D. Powers, *Strategy Without Slide-Rule*, London, 1976, pp. 11–106; Cole and Cheesman, *Air Defence*; M. Cooper, *The Birth of Independent Air Power*, London, 1986; and C. M. White, *The Gotha Summer*, London, 1986.
 63. For example, following the second Gotha raid on London (7 July 1917), the British War Cabinet, under heavy public pressure to undertake retaliatory actions, sought legal advice regarding the bombing of cities. The responding memorandum of law stated: 'No legal duty has been imposed on attacking forces to restrict bombardment to actual fortifications, and the destruction of its public and private buildings has always been regarded as a legitimate means of inducing a town to surrender'. G. H. Mills, 'Bomber Command of the Royal Air Force', *Air University Quarterly Review*, VII, (No. 4, Spring 1955, pp. 37–49, p. 40).
 64. Williams, 'Legitimate Targets', at p. 581, n. 36.
 65. Raleigh and Jones, *The War in the Air*, Vol. V, pp. 86–8. For other examples, see Powers, *Strategy without Slide-Rule*, p. 22.
 66. Post-Second World War critics of the strategic air offensive against Germany have argued that the attack on the morale of the German people was unsuccessful (see Hastings, *Bomber Command*, fn. 7, p. 323; and Best, *Humanity*, p. 283 [quoting G. Wright, *The Ordeal of Total War, 1939–1945* New York, 1968, p. 181]), for the most part relying upon a single paragraph

in the *Summary Report (European War) of The United States Strategic Bombing Survey* Washington, 1945, p. 16. However, the assessment by the Morale Division of the USSBS was quite specific in concluding that 'Bombing seriously depressed the morale of German civilians' (*The Effects of Strategic Bombing on German Morale*, Washington, May 1947, p. 1). Any discrepancy between the two reports may be explained by the fact that John Kenneth Galbraith and George Ball, civilians with USSBS who held strongly anti-military prejudices, were highly influential in the contents of the *Summary* report, and actively sought to downplay the effect of strategic bombing (Galbraith, 'After the Air Raids', *American Heritage* 32, 3, April/May 1981, pp. 65-80). See also D. Mac Isaac, *Strategic Bombing in World War Two: The Story of the United States Strategic Bombing Survey*, New York, 1976. Williamson Murray, in *Luftwaffe*, Baltimore, 1985, concludes (p. 283): 'The "area" bombing attacks did have a direct and palpable effect on the morale of the German population, and the German leadership, in response to that impact, seriously skewed Germany's strategy' While the effect on morale cannot be disregarded completely, as critics suggest, from the standpoint of military efficiency it appears to be an ancillary consideration in the attack of other targets rather than an effect that can be sought independently. See also J.M. Spaight, 'Morale as Objective', *The Royal Air Force Quarterly* 3, 4, October 1951, p. 287.

67. For a detailed description of the planning and execution of this attack, see W. Hays Parks, 'Crossing the Line', *US Naval Institute Proceedings*, 112, 11, November 1986, pp. 40-52.
68. It is estimated that almost 800,000 German civilians died of starvation as a result of the British naval blockade of Germany during the First World War. Seward, 'Bomber' Harris, p. 299. See also L. Guichard, *The Naval Blockade* (New York, 1930), and M. C. Siney, *The Allied Blockade of Germany 1914-1916*, Ann Arbor, 1957.
69. Henry W. Miller, *The Paris Gun*, New York, 1930.
70. Cf. Webster and Frankland, *Strategic Air Offensive*, I, p. 46, which notes that '[The] exaggeration of the number of casualties which strategic bombing was likely to produce was a major factor in all strategic thinking before the Second World War and exercised a profound influence on the minds of the services, the political chiefs, and, being translated into even more sensational language by journalists and publicists, on public opinion at large.'
71. As described in Michael Howard, *The Continental Commitment*, London, 1972.
72. E. L. Homze, *Arming the Luftwaffe*, Lincoln, Nebraska-London, 1976, p. 3.
73. As quoted in K. A. Maier, 'The Relationship Between Air Doctrine and Total War', presentation before the Air War College, Maxwell Air Force Base, 11 September 1980. In fact, the call for war crimes trials met with virtual rejection. See J. F. Willis, *Prologue to Nuremberg: The Politics and Diplomacy of Punishing War Criminals of the First World War*, Westport, CT., 1982.
74. Thus in official correspondence to the head of the British delegation (23 November 1921), it was noted that '... Although good relations between [Great Britain and France] will no doubt continue, the [Committee of Imperial Defence] cannot but view the situation which may arise in a few

- years' time if the French military proposals are carried out whilst Great Britain is reducing her fleet. The committee regards the comparative air strengths of France and Great Britain as even more serious The danger to England to attack by a French air force is very great ' Ernest Lo Woodward and Rohan Butler (eds), *Documents on British Foreign Policy, 1919-1939*, First Series, Vol. XIV, London, 1966, p. 498.
75. A. J. Toynbee, *Survey of International Affairs, 1920-1923*, London, 1925, p. 498.
76. See R. L. Buell, *The Washington Conference*, New York, 1922, pp. 201-39, 417-18; T. H. Buckley, *The United States and the Washington Conference, 1921-1922*, Knoxville, 1970, pp. 40, 121-26; US Department of State, *Conference on the Limitation of Armament*, Washington, 1922; and *Foreign Relations of the United States, 1922*, Vol. I, Washington, 1938, p. 228.
77. As with all aspects of law and politics, personal relationships often play a key role. As a professor of law at Columbia in 1900, Ambassador Moore began the Naval War College's International Law Studies series that continues to this day. As President of the Naval War College nine years later, Admiral Rodgers became close friends with Ambassador Moore. Acceptance of the Navy draft rules was inevitable, too, as they closely approximated to the philosophy of rules developed by the International Law Association in August 1922, discussed below, n. 91.
78. Norman Polmar, *Aircraft Carriers*, New York, 1969, pp. 1-53.
79. *Ibid.*, at pp. 44-5; and A. F. Hurley, *Billy Mitchell: Space Crusader for Air Power*, New York, 1964, pp. 58-70. US Navy opposition to strategic bombing concepts cannot be overstated. This opposition was mission- and budget-related, and would continue until the Japanese attack on Pearl Harbor destroyed the myth of battleship invulnerability (and would return in the post-Second World War interservice debates over aviation roles and missions of the Navy and Air Force). One example will be offered to illustrate the intensity of the debate. On 12 May 1938 Army Air Force B-17 aircraft intercepted the Italian liner *Rex* 776 miles off the East Coast of the United States; the photograph of the B-17 overflight appeared in more than 1,800 newspapers, magazines, and other periodicals. The following day, apparently following Navy protests, Army Chief of Staff Malin Craig directed that thereafter all over-water flights by Air Force aircraft were not to exceed a distance of one hundred miles from the shore - the logic being that attacks at a greater distance were a Navy mission. DeWitt S. Copp, *A Few Great Captains*, New York, 1980, pp. 418-24.
80. Polmar, *Aircraft Carriers*, pp. 36-7.
81. J. B. Moore, *International Law and Some Current Illusions*, New York, 1924, pp. 182, 194.
82. *Ibid.*, p. 194. In this regard the Ambassador's philosophy suffered from a philosophical deficiency. Commanders generally work in a 'target-rich' environment, and targeting doctrine over the years has emphasised attack on those targets posing the greatest threat, or which would result in the greatest damage to the enemy's war effort. The doctrinal philosophy encourages efficiency in the selection of targets and employment of the commander's military assets, while arguing against attack on non-military targets or indiscriminate attack on the civilian population.

83. *Ibid.*, p. 197.
84. W. Hays Parks, 'Rolling Thunder and the Law of War', *Air University Review*, XXXIII, 2, January - February 1982, pp 2-23. For a pilot's view of the devastating effect of these restrictions, see Jack Broughton, *Thud Ridge*, New York, 1969, and *Going Downtown*, New York, 1988; and J.B. Nichols and Barrett Tillman, *On Yankee Station*, Annapolis, 1986.
85. The difficulty has been caused in large measure by the necessity for secrecy of nations at war in the struggle for measures, countermeasures, counter-countermeasures, etc., particularly in highly sensitive areas such as electronic warfare. It has been only over the past decade that much of the electronic warfare battle of the Second World War has been revealed. See, for example, R. V. Jones, *The Wizard War*, London, 1978; Alfred Price, *Instruments of Darkness*, London, 1978; and Martin Streetly, *Confound and Destroy*, London, 1978.

An example from the Second World War electronic battlefield suggests the difficulty of accountability. On 31 May 1941 ninety Luftwaffe aircraft set out to conduct a night attack on Bristol and Liverpool, depending upon ground-based radio beams for guidance to their target areas. But British countermeasures jammed the radio beams, possibly causing one attacker to bomb Dublin in neutral Ireland, killing thirty-four civilians. Winston Churchill attributed this to British countermeasures (*Their Finest Hour* [London, 1949], p. 389), based upon a suggestion made to him in 1946 by R. V. Jones. The evidence of a causal relationship is inconclusive (cf. Price, *Instruments of Darkness*, p. 37, and Robert Fisk, *In Time of War*, Philadelphia, 1983, p. 435), further illustrating the problems of accountability in the fog of war.
86. See, for example, T. H. O'Brien, *Civil Defence*, London, 1955; United States Strategic Bombing Survey, *Civil Defense Division - Final Report*, Washington, 1945; and Stanford Research Institute, *Appendixes 1 through 7 to the Hamburg Police President's Report on the Large Scale Air Attacks on Hamburg, Germany, in World War II*, Menlo Park, California, 1968, pp. 39-271, which contains civil-defence materials for one German City.
87. Schindler and Toman, *Laws*, p. 142.
88. W. L. Rodgers, 'The Laws of War Concerning Aviation and Radio', *The American Journal of International Law*, 17, 1923, pp. 629-40, p. 633.
89. *Ibid.*, p. 633.
90. See, for example, J. M. Spaight, 'The Doctrine of Air Force Necessity', *British Year Book of International Law*, VI, 1925, p. 4: 'To imagine that, because of any paper rule, this foundation [attack of a military target, wherever located, without concern for collateral civilian casualties] will not be attacked is to dwell in a fool's paradise No restrictive covenant can avail to prevent that which is the nature of things.'

Similarly, international lawyer J. W. Garner, addressing the Grotius Society in London on 15 January 1936, observed:

'Since the World War . . . there has been a disposition to neglect the law of war and to abandon, in the main, further effort to rehabilitate and strengthen it. As everyone knows, the law of war was very much discredited by the events of the World War. Mankind generally lost faith in its

utility. Many persons spoke of it more or less contemptuously as the "so-called" law of war, as if a rule of conduct embodied in a convention dealing with war is any less a rule of law than one embodied in a convention dealing with matters of peace. University professors dropped the subject from their courses, and even text writers omitted it from their books, or at least passed it over lightly. As you know, the curatorium of The Hague Academy of International Law has not permitted the law of war to be discussed at any sessions of the Academy . . .'. J. W. Garner, 'The Outlook for the Law of War and of Neutrality', *Transactions of The Grotius Society*, 22, 1936, p. 1).

91. Elbridge Colby, 'Aerial Law and War Targets', *The American Journal of International Law*, 19, 1925, p. 713: 'In August, 1922, the International Law Association at its meeting in Buenos Aires, declared that the radius of operations of military aircraft ought to be restricted, and thus attempted to take from armies all the advantage which an aircraft . . . permits These were vain and fruitless efforts to send the science of war backward in its steps.' The work of the International Law Association undoubtedly formed a part of the basis for Ambassador Moore's support for the Navy draft, and in fact may have been a basis for the Navy draft.
92. See, for example, W. C. Chambliss, 'Air Bombardment Regulation', *US Naval Institute Proceedings*, 60, 11, November 1934, pp. 1577-81.
93. Webster and Frankland, *Strategic Air Offensive*, pp. 14-15.
94. *Ibid.*, vol. IV, pp. 72, 78.
95. *Ibid.*, vol. IV, p. 74. The term 'military objective' remained undefined in the law of war for another half century. Ultimately it was defined in article 52(2) of Additional Protocol I of 1977 as 'those objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage.'
96. See, for example, Colby, 'Aerial Law'; F. E. Quindry, 'Aerial Bombardment of Civilian and Military Objectives', *Journal of Air Law and Commerce*, II, 4 October 1931, pp. 474-509; and particularly J. M. Spaight, *Air Power and War Rights*, London, 1924, pp. 226-59.
97. Spaight, *Air Power*, pp. 233-5.
98. See, for example, J. W. Garner, 'International Regulation of Air Warfare', *Air Law Review*, III, 2, April 1932, pp. 103-26, p. 117. See also Stone, *Legal Controls*, p. 338, where he observes:

'The bounds between the legitimate pursuit of victory, and the infliction of suffering unnecessary to victory, may in words seem clear and settled. Concretely, however, they have been revolutionised in the last half century. When air supremacy becomes a critical factor in victory, and when sixty civilians and masses of industrial equipment must stand behind each plane in the air, the humane principle of civilian immunity retreats before the search for victory by the cheapest and quickest means.' Cf. note 34 above.

99. Sherman, *Memoirs*, Vol. II, pp. 112-29, contains the entire exchange of correspondence.

100. Colby, 'Aerial Law', p. 705.
 101. Ibid., p. 94; and Quindry, 'Aerial Bombardment', pp. 500-1, which noted that in a 1927 US Air Corps peacetime test by aircraft against a bridge 400 feet wide (approximately 120 metres), it was estimated that only 11 per cent of the bombs would strike the target. In the actual bombing tests, 27 per cent of the bombs struck the target. Quindry commented: 'Even under these conditions, where the bombs are dropped from a relatively low altitude [6,000 feet, or 1,800 metres] and by especially trained personnel, a great majority of them will hit only in the vicinity of the objective.'
 102. Webster and Frankland, *Strategic Air Offensive*, Vol. IV, p. 73.
 103. R. E. Bilslein, *Flight Patterns*, Athens, 1983, p. 25.
 104. The records of the Commission are contained in *Commission of Jurists to Consider and Report Upon the Revision of the Rules of Warfare*, The Hague, 1923. See also L. H. Brune, 'An Effort to Regulate Aerial Bombing: The Hague Commission of Jurists, 1922-23', *Aerospace Historian*, 29, 3, September 1982, pp. 183-5; and R. H. Wyman, 'The First Air Rules of Warfare', *Air University Review*, XXXV, 3, March - April 1984, pp. 94-102.
 105. H. Montgomery Hyde, *British Air Policy Between the Wars*, London, 1976; Powers, *Strategy without Slide-Rule*, pp. 107-207; Uri Bialer, *The Shadow of the Bomber: The Fear of Air Attack and British Politics 1932-1939*, London, 1980; Kennett, *Strategic Bombing*, pp. 58-71; Malcolm Smith, *British Air Strategy Between the Wars*, London, 1984; Williamson Murray, *Strategy for Defeat: The Luftwaffe, 1933-1945*, Maxwell Air Force Base, 1983; idem, *Luftwaffe*, p. 106; and W. L. Rodgers, 'Future International Laws of War', *The American Journal of International Law*, 33, 1939, pp. 441-51.
- Admiral Rodgers was not alone in his views. International lawyer J. W. Garner observed in 1936:

'The fact of the matter in the law of war . . . is . . . in a somewhat chaotic state, and when the next great war comes, if unhappily it does come - it will have to be carried on in large measure without rules that have been agreed upon, or with rules which have not been settled and as to the meaning of which there has been no argument. As to air warfare I think we can say there is practically no conventional International Law dealing with it . . . - Garner, 'Outlook', p. 5.

107. L. F. L. Oppenheim, *International Law*, 7th edn, Vol. II: *Disputes, War and Neutrality*, London, 1952, p. 523.
108. While the first rule is an accurate reflection of the law as it existed at the time as well as today, the difficulty with the last two rules lay in their favouring a defender (who would endeavour to camouflage and defend targets) over an attacker (who was required to identify that which the defender was concealing, dispersing and defending). Although 'reasonable care' may be an appropriate standard, suggesting good-faith intent or effort on the part of an attacker, 'carelessness' (or 'negligence', as the League of Nations resolutions was worded) is a less-than-perfect legal standard so long as an attacker is not in control of all the elements affecting his degree of care.

109. Document A. 69, 1938 IX, *League of Nations Official Journal*, Special Supplement 182, 1938, pp. 15-16.
110. US Department of State, *Foreign Relations of the US*, 1939, I, General Washington, GPO, 1956, pp. 541-2.
111. *Ibid.*, pp. 542-57.
112. K. A. Maier, 'Total War and German Air Doctrine Before the Second World War', in W. Deist (ed.), *The German Military in the Age of Total War*, Leamington Spa, 1985, p. 210-19, p. 211.
113. *Coenra Brothers v. Germany* (1927), in Arnold Duncan McNair, Baron McNair and Lauterpacht, Sir Hersch (eds), *Annual Digest of Public International Law Cases*, London, 1931, pp. 570-2. The warning requirement in article 26 of the Annex to Hague IV of 1907 states that 'the officer in command of an attacking force must, before commencing a bombardment, except in cases of an assault, do all in his power to warn the authorities'. At the time of the German attack, Greece was neutral. Once hostilities have begun, in actual practice the warning requirement is less of an issue owing to the exception for assaults. See also *Kereadolt v. Germany*, 1930, *Annual Digest*, p. 516.
114. *The Breaking Wave*, New York, 1967, pp. 112-18.
115. Telford Taylor, *Final Report to the Secretary of the Army on the Nuremberg War Crimes Trials Under Control Council Law No. 10.*, Washington, 1949, p. 65.
116. G. Brand, 'The War Crimes Trials and the Laws of War', *The British Year Book of International Law*, XXVI, 1949, pp. 414-27. The issue of legality of bombing was raised in other ways in some trials, as in the charge against former Luftwaffe chief Hermann Goering of 'devastation of towns, not justified by military necessity, in violation of the law of war'. Indictment (Count Three), in *Trial of Major War Criminals by the International Military Tribunal*, I, 1947, pp. 42-3, 61-2. The issue was considered in volume IX of the same trials to pp. 175-8, 214-19, and is summarised in R. E. Conot, *Justice at Nuremberg*, New York, 1983, pp. 334-5.
117. The United States Air Force was not formed as a separate service until 18 September 1947. US Army Air Corps planners would have looked to the Army law-of-war manual for guidance. A separate US Air Force manual on the law of war was not completed until 19 November 1976, more than three decades following the conclusion of the war.
118. James Molony Spaight, mentioned in the text accompanying note 97, was the author of *Air Power and War Rights*. First published in 1924, a second edition was published in 1933; each was far more comprehensive than any law-of-war manual utilised by any military service at that time.
119. An Australian legal scholar of the time concluded: '... the law of war is to-day under a cloud. It is highly doubtful whether it can any longer be called "law". The 1929 Edition of the British Manual of Military Law recognises this and is not able to do more than repeat the rules as they existed in 1914 ...'. A. N. Lewis, *Australian Military Law*, Hobart, 1936, p. 214.

The 1958 British *Manual of Military Law*, which is the current manual, contains the following: 'The title of this Part of the Manual, "The Law of War on Land," makes it clear that it is not concerned with the law of warfare at sea or with aerial warfare. Nevertheless, the rules governing

land combat will apply to members of naval and air forces when employed in combat duties on land.' Today, forty-nine years after the start of the Second World War, the Royal Air Force still does not have a law-of-war manual, despite the fact that Hague Convention IV (to which the United Kingdom has been a party since 27 November 1909) requires that each party 'issue instructions to their armed forces which shall be in conformity with the Regulations respecting the laws and customs of war on land . . . ' [article 1].

120. H. Arthur Steiner, 'Italian War and Neutrality Legislation', *The American Journal of International Law*, 33, 1939, pp. 151-7, p. 157.
121. The list is on pp. 233-5 of the second edition.
122. With lengthy discussion, pp. 195-210.
123. *Ibid.*, p. 210. While this may reflect emergent thinking of scholars of the time, it did not constitute an obligation accepted by nations. A single scenario suggests the impracticality of the rule. Assume a bomber force battles its way to its target deep in enemy territory, only to find the enemy has obscured the target - located in the midst of a populated area - with smoke. It would be foolhardy to think that the bombers would not bomb anyway, regardless of the consequences to the civilian population. Any other action would encourage a defender to continue his actions in order to frustrate any bombing.
124. *Ibid.*, p. 211.
125. *Ibid.*, pp. 239-47.
126. *Ibid.*, pp. 222-6, 253-4.
127. *Ibid.*, pp. 247-52.
128. Dr Royse served as a United States Marine Corps aviator in the First World War, obtained his Ph. D. in international relations from Columbia following the war, and served with the Office of Strategic Services during the Second World War. Between the wars and following the Second World War he enjoyed a distinguished university teaching career.
129. New York, 1928. See also M. W. Royse, in ICRC, *La Protection des Populations Civiles Contre les Bombardements*, Geneva, 1930, pp. 72-116.
130. Royse, *Aerial Bombardment*, p. 147.
131. *Ibid.*, pp. 238, 241.
132. Above, n. 129.
133. Royse, *Aerial Bombardment*, pp. 73-4, 79.
134. Philip C. Jessup, 'International Law and Totalitarian Law', *American Journal of International Law*, 35, 1941, p. 329.
135. Stone, *Legal Controls*, pp. 349-50.
136. Thus, while the Vietnam War was fought as a limited war by the United States, it was regarded as total war by the North Vietnamese. The 1982 Falklands-Malvinas War was fought as a limited war by both sides, but on a battlefield virtually devoid of civilians. The Arab-Israeli Wars have been fought against a background of superpower influence in which each has encouraged constraint by the combatant nations in order to avoid superpower confrontation. Use of chemical weapons - weapons regarded as prohibited under international law, and a weapon to which no nation resorted during the Second World War - by Iraq in its conflict, and by the Soviet Union in Afghanistan, not only illustrates the philosophical distinction

- with which non-Western nations view international law and the law of war, but the lack of an enforcement mechanism available to the law of war.
137. The law of war essentially remains a Western concept. Although the 1949 Geneva Conventions for the Protection of War Victims are law-of-war treaties to which 90 per cent of the nations of the world are party, even these fundamental treaties enjoy limited acceptance in practice outside the Western world.
 138. Webster's Third New International Dictionary of the English Language, Boston, 1976.
 139. See, for example, Frits Kalshoven, *Belligerent Reprisals*, Leiden, 1971, in which the author concludes that the Luftwaffe bombing of London on 24 August 1940 and RAF Bomber Command's response against German cities were (based solely on results and dismissing intent, while acknowledging enemy defences) 'indiscriminate' (pp. 164-5, 168-9). Historically bombing accuracy diminishes by 200 per cent once an aircraft is taken under fire. Thus, an aircraft whose normal Circular Error Probable (the radius of a circle within which half of the bombs are expected to fall) is (for example) 500 metres would increase to 1500 metres once the aircraft is taken under attack.
 140. See, for example, Best, *Humanity* 7, p. 280, who selects mid-1944 as that point in the war when RAF Bomber Command in particular should have been more discriminate in its attacks. Cf. John Terraine, *The Right of the Line*, London, 1985, p. 678, in which, speaking of a later time (February 1945), he remarks: '... only the luxury of hindsight and the detachment of non-participation can undervalue the enormous sense of that weight of time, the intense desire to bring the whole business to an end as quickly as possible, that possessed not merely Bomber Command, or the Royal Air Force, but virtually the whole nation'. The supposition also ignores other outside influences, such as weather. While US B-17 crews fought valiantly to make their case for daylight precision bombing, in the closing months of 1944, utilising radar bombing through 10/10ths cloud, bombing accuracy decreased rather than improving. Against Japan, for a variety of reasons, bombing efforts were not directed against precise industrial targets, but against urban areas - as RAF Bomber Command had been carrying out its attacks over Germany. See Gary Shandroff, 'The Evolution of Area Bombing in American Doctrine and Practice', Unpublished Dissertation, New York University, 1972.
 141. As described in Paul Brickhill, *The Dam Busters*, London, 1951; Helmuth Euler, *Als Deutschlands Dämme Brachen*, Stuttgart, 1978; Alan W. Cooper, *The Men Who Breached the Dams*, London, 1982; and John Sweetman, *Operation Chastise*, London, 1982.

The Luftwaffe and Indiscriminate Bombing up to 1942

Horst Boog

The attitude of the German Air Force towards indiscriminate or terror bombing is disputed in historical literature, but the Luftwaffe has been portrayed as a terror air force and associated with names like Guernica, Warsaw, Coventry and Belgrade. Circumstances supported this view, because as the basic mission of the Luftwaffe was to support the army and the kind of war most likely in Central Europe was a land war, the German Air Force was, right from the beginning, confronted with attacks on defended cities. Moreover, it was Hitler's Germany that started the war. Hitler was a villain, and it is thus often assumed that everything done in his name and under his regime must have been evil. Literature sometimes creates the impression of a Luftwaffe that, from the outset, disregarded all rules of humanity. This hardly applies to Anglo-Saxon literature, which, after the fog of war propaganda had dissipated, generally took a sober and fair stand on the matter. To avoid misunderstandings right from the start the reverse conclusion that, if not everything done by Hitler's Wehrmacht was evil, Hitler's policy and regime could not have been quite so bad, will not be drawn here because, in view of the nature and the misdeeds of this regime, it would be a false conclusion. However, realism and justice should prevail where appropriate.

When studying the problem¹ it must be kept in mind that one cannot judge the normal performance of an air force on the basis of a few borderline cases or air attacks distorted for propaganda purposes. A distinction must be made on the one hand between the secret and public propaganda statements made by some politicians and the occasional, emotional statements of some Luftwaffe commanders, studies and deliberations, and, on the

- with which non-Western nations view international law and the law of war, but the lack of an enforcement mechanism available to the law of war.
137. The law of war essentially remains a Western concept. Although the 1949 Geneva Conventions for the Protection of War Victims are law-of-war treaties to which 90 per cent of the nations of the world are party, even these fundamental treaties enjoy limited acceptance in practice outside the Western world.
 138. *Webster's Third New International Dictionary of the English Language*, Boston, 1976.
 139. See, for example, Frits Kalshoven, *Belligerent Reprisals*, Leiden, 1971, in which the author concludes that the Luftwaffe bombing of London on 24 August 1940 and RAF Bomber Command's response against German cities were (based solely on results and dismissing intent, while acknowledging enemy defences) 'indiscriminate' (pp. 164-5, 168-9). Historically bombing accuracy diminishes by 200 per cent once an aircraft is taken under fire. Thus, an aircraft whose normal Circular Error Probable (the radius of a circle within which half of the bombs are expected to fall) is (for example) 500 metres would increase to 1500 metres once the aircraft is taken under attack.
 140. See, for example, Best, *Humanity* 7, p. 280, who selects mid-1944 as that point in the war when RAF Bomber Command in particular should have been more discriminate in its attacks. Cf. John Terraine, *The Right of the Line*, London, 1985, p. 678, in which, speaking of a later time (February 1945), he remarks: '... only the luxury of hindsight and the detachment of non-participation can undervalue the enormous sense of that weight of time, the intense desire to bring the whole business to an end as quickly as possible, that possessed not merely Bomber Command, or the Royal Air Force, but virtually the whole nation'. The supposition also ignores other outside influences, such as weather. While US B-17 crews fought valiantly to make their case for daylight precision bombing, in the closing months of 1944, utilising radar bombing through 10/10ths cloud, bombing accuracy decreased rather than improving. Against Japan, for a variety of reasons, bombing efforts were not directed against precise industrial targets, but against urban areas - as RAF Bomber Command had been carrying out its attacks over Germany. See Gary Shandroff, 'The Evolution of Area Bombing in American Doctrine and Practice', Unpublished Dissertation, New York University, 1972.
 141. As described in Paul Brickhill, *The Dam Busters*, London, 1951; Helmuth Euler, *Als Deutschlands Dämme Brachen*, Stuttgart, 1978; Alan W. Cooper, *The Men Who Breached the Dams*, London, 1982; and John Sweetman, *Operation Chastise*, London, 1982.

19

The Luftwaffe and Indiscriminate Bombing up to 1942

Horst Boog

The attitude of the German Air Force towards indiscriminate or terror bombing is disputed in historical literature, but the Luftwaffe has been portrayed as a terror air force and associated with names like Guernica, Warsaw, Coventry and Belgrade. Circumstances supported this view, because as the basic mission of the Luftwaffe was to support the army and the kind of war most likely in Central Europe was a land war, the German Air Force was, right from the beginning, confronted with attacks on defended cities. Moreover, it was Hitler's Germany that started the war. Hitler was a villain, and it is thus often assumed that everything done in his name and under his regime must have been evil. Literature sometimes creates the impression of a Luftwaffe that, from the outset, disregarded all rules of humanity. This hardly applies to Anglo-Saxon literature, which, after the fog of war propaganda had dissipated, generally took a sober and fair stand on the matter. To avoid misunderstandings right from the start: the reverse conclusion that, if not everything done by Hitler's Wehrmacht was evil, Hitler's policy and regime could not have been quite so bad, will not be drawn here because, in view of the nature and the misdeeds of this regime, it would be a false conclusion. However, realism and justice should prevail where appropriate.

When studying the problem¹ it must be kept in mind that one cannot judge the normal performance of an air force on the basis of a few borderline cases or air attacks distorted for propaganda purposes. A distinction must be made on the one hand between the secret and public propaganda statements made by some politicians and the occasional, emotional statements of some Luftwaffe commanders, studies and deliberations, and, on the

other hand, the real conduct of the air war, its actual aims and intentions in specific operations, as reflected in the respective operation orders. It is, for instance, not simply a matter of examining doctrine and regulations: just as Royal Air Force doctrine did not lead directly to terror bombing by Bomber Command, which was prompted by additional circumstances and reasons, the doctrine of the German Air Force did not keep it – let this be said at the outset – from engaging in it in the long run. In this case, too, certain special conditions of the war were the cause. The specific intent normally expressed in directives and operation orders seems to provide the safest basis for an assessment of the question being discussed here. For if the results of bombing raids are taken as a criterion, they would have to be labelled – like the first British bombing raids on targets in Germany after 11 May or 15 May 1940 – ‘indiscriminate’ very early on, although they were not intended to be indiscriminate at all at that time. At the start of the war, no bomber force was able to hit its target accurately, although there were distinct differences as far as the efforts to achieve accuracy were concerned. All bomber forces, therefore, accepted the risk of unintended damage beyond their military targets right from the beginning.² Otherwise, their final conclusion would have been that they should disband, which in turn would prove a rather unrealistic demand. Apart from the specific operational intent, any assessment of the willingness to abide by international law must also take into account the efforts of the air powers to confine damage to ‘genuine military targets’ by imposing conceptual, tactical and technical constraints.

In his response to Roosevelt’s appeal on 1 September 1939, Hitler, too, had explained that he also believed in refraining from ‘air raids on non-military targets outside of military operations’.³ He had made proposals with that wording in connection with the Locarno powers’ attempt to come up with an air pact in 1935 and one year later.⁴ But in his speech to the Reichstag on the day the war started, he specifically emphasised the principle of reciprocity when he said: ‘He who abandons the rules of humane warfare can only expect us to take the same steps.’ Thus, he reserved the right to decide himself what was to be regarded as a violation of international law on warfare by the enemy. This was basically the same position Britain had adopted in the note of 2 September 1939.⁵ Even though both parties declared that they had instructed their air forces to bomb military targets only – which was indeed the case – this reserva-

tion and the inaccuracy of the definition of the term 'military bombing targets' for the purposes of air war, and the fact that this term could hardly be defined, already foresaw the degeneration of strategic air warfare into indiscriminate bombing – all the more so because the international law on air warfare obtaining in 1939 gave only extremely inadequate protection to the civilian population⁶ while, on the other hand, exposing it to extreme danger from the bombing of 'military targets'. All that was needed was the reasons, and finding those was a matter left to the discretion of the parties involved. Of course, no one wanted to be the first to bomb the civilian population, if only to avoid making a negative impression on world-wide public opinion. Just as the bombing doctrine of the Royal Air Force aiming at the morale of the enemy was not advertised in public, initially Hitler only unveiled his true intentions in a secret address to the Reichsleiters and Gauleiters on 21 October 1939. He would conduct the planned offensive against Britain 'with all available means', while reassuring the world that he wanted to comply with international rules. In reality, however, he had no intention whatsoever of being considerate, and would attack 'open cities'.⁷

Such Douhet-like concepts, considerations and fears about future bomb warfare had existed in the heads of most politicians and air-warfare theorists of many countries, including Germany, even before the war. One need only recall Dr Knauss's memorandum in 1933 on the High Risk Air Force, his account of the destruction of Paris, then attributed to the realm of science fiction; the essays of Gehrts and Macht and also Herhudt von Rhoden,⁸ that were influenced by the theory of total war and the National Socialist ideology of the community of the people, which claimed that air warfare against the civilian population would lead to an earlier collapse of the enemy than conventional land warfare; the air situation report of 2 May 1939 by the Chief of Intelligence (Ic) of the Luftwaffe General Staff, who claimed that Germany had an advantage over all the other nations because she had prepared for total air warfare, i.e. air warfare that would also affect the civilian population.

However, in the light of recent research one may at least doubt that the preparedness to accept the risk of total war and bombing as expressed in such semi-official and official documents reflected the real conviction of the supreme political leadership of the Third Reich and the Luftwaffe, i.e. whether the leaders of the Third Reich accepted the risk of a major war

because they were convinced of their internal strength.⁹ Recalling the collapse of the German home front in 1918, the German political leadership and the highest authorities of the Reich feared, for a long time after the start of the war, a similar development if the German people were to be hit too hard by the mobilisation of its labour and economic resources. In view of this, the continued willingness to take any risk seems more like the gamble of a chancer, and a product of a policy of deterrence and blackmail, i.e. the type of intimidating propaganda directed at the potential enemy as already practised before the war, in whose net the authors named above and ranking Luftwaffe officers apparently had become entangled. In retrospect, Hitler's proposal to incorporate a restriction of bombing to military and naval areas of operation¹⁰ into the Anglo-German air-warfare agreement discussed in 1935 may have been one of the few things he really meant – not for humanitarian reasons but for fear of the consequences arising from the absence of restrictions – notwithstanding other emotional statements of his found here and there. However, this proposal was rejected by Britain because it would not have benefited from it, as the British wanted to carry out strategic bombing right from the beginning.

Hitler, and still more Goering, who did not hesitate even in diplomatic negotiations to threaten the other parties with Luftwaffe bombing raids on their cities,¹¹ and also the German press, centrally controlled by Goebbels, gave the world the impression of a German Air Force determined to resort to ruthless bombing, even against the civilian population. They created the image of a German Air Force as the relentless executor of Nazi and racist politics of expansion and of Hitler's ambition to achieve Great-Power status.

This notion was encouraged especially by the German air raid on Guernica, Spain, on 26 April 1937. It had been intended as a bombing raid in support of the military objective of interdicting the withdrawal of Republican ground forces. To do this, a road bridge and its access roads had to be destroyed.¹² The outcome under actual battlefield conditions of smoke formation and the readiness of the crews to 'simply drop their ordnance right into the middle of the smoke' looked like a terror attack. Perhaps this attack and the bombing of other cities in the Spanish Civil War can also be interpreted as a veiled attempt, under the pretext of being a military necessity, to study the effects of those officially banned attacks on the civilian population, although accomplishment of the combat mission in the case of Guernica included

blocking the approaches to the bridge, which was only possible from the air with the rubble of the houses. Unlike similar events in the war in Abyssinia or in the Sino-Japanese War, Guernica as a new phenomenon on such a scale for the first time in European civilisation (apparently the First World War bombardments of cities had been forgotten), shape the image of the Luftwaffe (with lasting effect) as a strategic terror weapon.

The Luftwaffe, however, did not live up to such an image, either in matters of doctrine or training and equipment, and one can only agree with Geoffrey Best's assertion that the image of the Luftwaffe painted by Nazi propaganda 'embarrassed' a large part of the Luftwaffe, mainly its 'respectable part'.¹³ Even though it was becoming exposed to National Socialist indoctrination, the internal attitude of the Luftwaffe was that of a military instrument within the framework of traditional continental military principles and the rules of international law on air warfare. Therefore, it cannot simply be identified with the social-Darwinist aspirations and intentions of the Nazi political leadership, just as the slogan 'Nazi Air Force' cannot be applied indiscriminately.¹⁴

The essential provisions of international law on air warfare were disseminated regularly.¹⁵ In addition, there was a binding GAF regulation, L.Dv. 64 II, governing International Law in War, a collection of international agreements of significance for major commanders, dated 1 October 1939, which says in the introduction:

Compliance with the rules of warfare will help to conduct war with fairness and gallantry. As experience has shown, non-compliance will produce reprisals by the enemy and would be a welcome opportunity for his propaganda All agreements on the international law on war are important for the *military leadership*, including those which never became legally binding or have not progressed beyond the draft stage but have gained great practical importance, such as the 1909 Declaration of London on Naval Warfare and the draft of an Agreement on Air Warfare of February 1923.

In addition to general agreements and agreements on naval warfare, the air force regulations also contain the essential provisions on air warfare, in particular Article 25 of the Hague Convention on Land Warfare and the Hague Rules on Air Warfare of 1923, noting that 'though not legally binding . . . they are important guidelines for the development of future law

on air warfare' and that the provisions on 'the bombardment of *military installations* in undefended towns' would apply accordingly to independent air warfare.¹⁶

The initially positive acceptance of Douhetism had been replaced as early as the mid-1930s by a concept oriented more towards tactical and operational than strategic air warfare.¹⁷ The Luftwaffe was to be employed primarily in the near and far area of operations of the Army and Navy, and not so much against targets in the enemy hinterland, such as cities. Terror or retaliatory attacks were permitted only as an exception to the rule in the form described by international law as reprisals. In the basic Luftwaffe regulation No. 16 (L.Dv. 16) of 1935/40, the relevant paragraph 186 reads as follows:

Attacks on cities for the purpose of terrorising the civilian population should always be declined. However, should the enemy conduct terror raids on unprotected and undefended open cities, retaliatory attacks may be the only means of forcing the enemy to refrain from this brutal form of air warfare. The timing [of retaliation] will be determined primarily by the preceding enemy terror raid. In all cases the retaliatory nature of the attack must be made perfectly clear.

The seven subsequent paragraphs deal with the ways and means of conducting retaliatory attacks, thus indicating that much thought had been given to the problem.

In the proposals of 20 July 1939¹⁸ of the Luftwaffe General Staff on air warfare designed to limit 'the leeway of commanders only to the extent dictated by our own war interests' and to 'cover' their activities within these confines, proposal No. 22 once more prohibits 'air raids intended to terrorise the civilian population, to injure non-combatants or damage or destroy goods of no military significance . . .'; and the subsequent proposals point out that the civilian population and civilian facilities are to be spared during air raids. The comments on proposal No. 22 point out again that terror raids on the civilian population violate international law, but note that 'the war situation . . . may, however, make such raids necessary', namely, as mentioned, in making reprisals. In any such case, however, the following will apply. 'Terror raids will be ordered by the Commander-in-Chief of the Luftwaffe only.' This provision was apparently intended to prevent abuse of this means and the risk of negligence on the part of air-force units involved in such operations. It went on: "'Goods of no military significance' will not

be attacked anyway for reasons of military expedience. They are mentioned in this proposal only for formal reasons.' The principle of economy, stemming from centuries of Prusso-German experience of limited *matériel* and personnel, and determining the attitude to command of the Luftwaffe in many areas, is also referred to here. 'The Luftwaffe depends', as its Chief of the General Staff put it during the 1939 General Staff ride, 'much more than the other staffs of the Wehrmacht on conducting the war as economically as possible.'¹⁹ This principle was one of the major factors of the persistent opposition of the Luftwaffe leadership to indiscriminate bombing.

Another factor was the classical continental perception of war as a military conflict between combatants, as expressed already in important statements of the manual on air warfare (paragraph 9 and 10, L.Dv. 16): 'The task of the armed forces in war is to break the enemy's will. The will of the nation finds its most pronounced manifestation in the *armed forces*. To overpower the enemy's armed forces therefore is the most eminent objective in war. It is the task of the Luftwaffe to serve this objective in conducting the war in the air within the framework of the overall war.'²⁰ The three main missions of the Luftwaffe are then given in paragraphs 18, 21, 22 and 31. The first, continuous task is 'to counter the enemy air force'. This is followed by 'participation in operations and battles on the ground and at sea', which can be called co-operation in the broadest sense, and finally 'bombing the sources of power of the enemy forces', including the 'disruption of the flow of power to the front', which seems to indicate that the latter was conceived more as general co-operation than independent strategic air warfare. An indication of this is that the first two tasks obviously have priority over the third, the one to which terror bombing could best be correlated, because bombing enemy sources of power is subject to certain conditions. Target selection must 'ensure that air operations affect the operations of Army and Navy *in time*'. This is, however, generally not the case. Operations against the sources of power

normally produce results very slowly and carry the inherent risk that their effect on the operations of the Army and Navy comes too late. They normally require the commitment of strong forces over a long time. Therefore, unless these operations involve targets whose destruction is expected to expedite the war effort, attacks on these sources of power and disruption of the flow of power to the front will

normally be justified only if land and naval operations are designed to *prepare* a decision; if decisive combat operations have come to an end or if a decision of the war can be expected *only* by destroying these sources of power, as stated in paragraph 31, to end 'an impasse in the war' [this obviously referred to the bloody but deadlocked trench warfare of the First World War], where the air force may be 'the only means' of 'preventing complete attrition' of friendly ground forces and to force a decision.

Once more the notion of economy is implied, and cost-effectiveness is put forward as an argument for the low priority of strategic bombing – a term which did not even exist in Luftwaffe terminology at that time. This argument was based not only on the traditional German concept of a short war, but also had a great influence on the decisions taken in 1936 and 1937 not to build a long-range but instead a medium-range bomber force, which was deemed more adequate for the tactical and operational role on the Continent, and would allow the procurement of more aircraft.²¹

Besides economic considerations and the classical Continental tradition of warfare one cannot ignore humanitarian considerations as a determining factor of the reserved or negative attitude of the Luftwaffe leadership towards strategic air warfare and terror bombing, although humanitarian considerations were, as I have already said, very much restricted by their 'own interest in war' and the succinct statement in the Luftwaffe Manual, No. 16 (L.Dv. 16): 'Unintentional side-effects cannot be excluded in air raids.'²² As the war progressed and in the context of what was perceived as military exigency – I assume this applies to all parties involved in the war – humanitarian aspects increasingly took a back seat or were governed only by a desire not to provoke harsh reaction by the enemy. Their importance in relation to economic and other considerations is certainly difficult to determine, and in most cases was of minor importance. In any case, the significance of the official explanation of the 24th of the above proposals of the Air Staff, which is based on humanitarian consideration, cannot simply be negated. It said that 'targets in densely populated areas *and* targets in the immediate vicinity of facilities on which air raids are prohibited . . . may only be attacked by aimed bombing.' This was obviously intended to protect the civilian population of the enemy from unnecessary harm.

The term 'aimed bombing' could mean many things,²³ such as

point drop or accurate delivery in a dive, delivery by slant attack (inclined flight) or high- and low-altitude raids in level flight with the aid of electronic navigational instruments and bomb-sights, or with clear vision to the ground. Humanitarian thinking together with the (dominating) economic considerations, especially in the Luftwaffe, actually led to two developments which distinguished the Luftwaffe at the beginning of the war considerably from the air forces of other powers, i.e. the dive-bomber force and radio-navigation procedures for the bomber force. Both aimed at accurate bomb-delivery, while reducing the total quantity of bombs and thus the number of planes needed for a mission.

Much has been written on the dive-bomber concept.²⁴ I shall not go into its origin and development here, but shall confine myself to the following remarks: even in the Reichswehr and before Udet joined the Luftwaffe (this date is often incorrectly regarded as the beginning of the dive-bomber era in the Luftwaffe) experiments with dive-bombers were conducted with the intention of minimising both effort and damage while maximising the effects. The dive-bomber concept, then promoted mainly by Udet and Jeschonnek, eventually dominated the whole Luftwaffe General Staff,²⁵ more so after delivery of bombs in level flight had proven highly unsatisfactory. Only against this background can it be understood why the implicit extension of a diving or slant attack requirement from the medium bombers to the planned four-engine He 177 bomber went unquestioned, and was assumed as virtually self-evident without ever having been laid down in writing by the Luftwaffe General Staff, and in spite of the fact that before the war the Technical Office had forecast technical feasibility in the case of the medium bomber only. It dominated the development of bombers, until the problems with the He 177 led even Goering to admit its absurdity; but in the meantime it had completely crippled the development of a long-range bomber force for strategic operations.

The original military requirements developed by the Air Command Office (Luftkommandoamt) (a cover name for GAF General Staff) did not at all limit dive-bomber employment to areas close to the front, which proved to be the only capability of the dive-bombers in the war, owing to the weight increase brought about by the nosediving equipment. The demands made on 31 January 1934²⁷ to the Technical Office also called for 'point targets deep in enemy territory', i.e. strategic targets, sources of power. Consequently, the 'whole concept of the operational

[would-be strategic] Luftwaffe was founded on a medium-range dive bomber'.²⁸ The Luftwaffe Manual D (Luft)g 1911 of September 1940 still read as follows: 'The primary task of the dive bomber is to attack fixed enemy installations of importance for military, war and survival purposes and of small physical dimensions (single and point targets).' Bombing training regulations stipulated in mid-1937 a mean dispersion of bomb impacts of not more than 58 m and 150 m off the target for a release altitude of 1,000 m and 6,000 m respectively.²⁹ Considering the classical Continental perception of warfare and its economic and humanitarian aspects, the effort to achieve precision bombing was also in line with the legal conception obtaining in Germany at that time, which still governed Luftwaffe training.³⁰ At the same time, however, the quantitative factor, which later proved decisive for the practice of strategic bombing – the importance of mass employment of bombers – did not receive due consideration, as substantiated by pre-war studies and by the mission orders discussed below for raids on Britain³¹ by single bombers manned by highly proficient crews. In spite of Churchill's reservations the British Air Ministry rejected the dive-bomber project.³² The German Air Force was the only one in the world which, for whatever reasons, subscribed to the dive-bomber concept so wholeheartedly and to its own detriment. It is significant that the Luftwaffe General Staff as late as in the autumn of 1939 rejected a research and development project for a system to engage area targets on the grounds that 'there is no intention on the German side to attack enemy area targets. Remote-controlled missile development projects should be proposed where feasible . . . for engaging point targets.'³³

At the start of the war, only the Luftwaffe had radio navigation for the most accurate bomb-delivery possible. In the 1930s, the Luftwaffe – like the British – developed not only radar equipment to detect approaching enemy aircraft, but also equipment to enable accurate target-location and precision bombing without optical visibility. The British only began work on this during the war.³⁴

In Germany, the radio-waves expert, Dr Hans Plendl, had begun as early as 1933 to develop from the instrument-landing equipment of the C. Lorenz Company an automatic bomb-sight which was operational as early as 1935, and was first presented during the Wehrmacht manoeuvres of 1937 and first fielded in 1938. As early as 1936 a radio direction-finder had been demanded at least for the lead aircraft of long-range bomber

formations.³⁵ Radio navigation was promoted by the Chief of Signal Communications and Inspector for Air Force Communications, Colonel Martini, and by the Commander of the Air Communications Experimentation Regiment, Lieutenant-Colonel Aschenbrenner, in the face of resistance from the Reich Aviation Ministry, where the long outdated visual flight-and-fight mentality of the First World War pilots still prevailed. With the so-called System X the attacking bomber rode on a radio beam placed over the target. At a distance of 50 km from the target the pilot and the navigator heard in a device aboard the plane the signal of another radio beam perpendicular to the line of attack which told them that they were close to the target. Twenty kilometres from the bomb-release point the aircraft would fly across another cross-beam, at which time the bombardier would activate a special clock connected to the bomb-release mechanism. Upon crossing the third and final cross-beam 5 km from the target, another hand on the same clock was activated, which automatically released the bombs as soon as it was aligned with the first hand. This system had a range of 300 to 400 km at flight altitudes of 5,000 to 7,000 m. At a distance of 300 km from the locating-beam transmitter its theoretical accuracy was ± 260 m in azimuth and 300 m down-range. In practice, the accuracy of this and subsequent systems was probably less than that stated above. In the winter of 1938 the Air Force Signal Battalion 100 was activated at Koethen, and assigned the task of making System X ready for combat use and training bomber flight-crews. In late November 1939 the battalion was redesignated Kampfgruppe 100, and on 15 December 1941 it became Bomber Wing 100 'Viking'. The first raids with System X had been flown during the Polish campaign. System X was used extensively after 13 August 1940 against Britain, especially in night raids. Starting in October 1940, the bombers of Kampfgruppe 100 equipped with System X first marked the designated targets with incendiary bombs. The bombers which followed then dropped their high-explosive ordnance into the resulting fires. The German Air Force had thus introduced the 'pathfinder' method which was adopted by the Royal Air Force Bomber Command only two years later.³⁶

In addition to System X, German industry (Telefunken) developed another system for precision bombing at night, the so-called 'Headache' (*Knickebein*), requiring only two beams, a localiser beam and a cross-beam to trigger the bomb-release mechanism over the target. This system was somewhat less

accurate, but could be handled more easily by the bomber crews. It was practically a simplified version of System X, operating without any special on-board equipment. Its range was 300 to 400 km at altitudes of 5,000 to 7,000 m above ground level, with a navigation error of about ± 380 at 300 km. 'Head-ache' was not used in Poland because its heavy transmitters could not be set up as quickly as the lighter X transmitters. Its use against Britain was jammed – although not completely – right from the outset.³⁷

Finally, late in 1940, a third radio navigation system, also developed by Dr Plendl, was fielded, the so-called Y Navigation System, which functioned with a just ground-based radio station and a localiser beam. The localiser beam was made up of 180 directional signals per minute. Special codes to measure the distance were interspersed. The accuracy of this system was ± 1 to 2 km along the axis of the localiser beam, and its range was 300 to 400 km at flight altitudes of 5,000 to 7,000 m. It was jammed from mid-February 1940 on.³⁸

Development of these navigation systems and automatic bomb-sights by the Luftwaffe would have made no sense had there been a decision to go for terror bombing of cities right from the beginning. But the aim of the Luftwaffe was to hit as precisely as possible military and industrial targets; and even though highly emotional notions of terror bombing may have been raised during conferences,³⁹ the Luftwaffe Chief of General Staff, Jeschonnek, preferred to ask for targets whose destruction would produce maximum and where possible immediate military weakening of the enemy.⁴⁰ Obviously he did not mean residential areas, although such statements have been attributed to him. Throughout the winter of 1940–1 the bomber crews were briefed frequently on the capabilities and limitations of the radio navigation systems. To prevent automatic dropping of bombs beyond the effective target radius, lower flight levels for the attack were ordered, and the 'most experienced crews' were used as the pathfinders to properly designate targets after accurate ground orientation for the crews which followed.⁴¹

Another indicator that the Luftwaffe was not interested in destroying big cities in the first years of war, but primarily in the elimination of the pre-selected and closely delimited targets, is the standard mix of high-explosive and incendiary bombs normally carried by bombers. Incendiary bombs, which were used mainly for target-marking during the air offensive against Bri-

tain in 1940-1, averaged not more than 7.7 per cent of the bomb-load, while that of the Bomber Command of the Royal Air Force soon exceeded 60 per cent.⁴² This led the long-time Commander of Bomber Command, Harris, to observe. 'The Germans missed their chance . . . of setting our cities ablaze in a concentrated attack.'⁴³ In the years 1940 and 1941 such an omission cannot yet be attributed to a shortage of bombers and incendiary bombs, but rather to the absence of any intention so to employ them, for the Luftwaffe leadership was aware that 'the desired effect dictates the type of mission and munitions' and that in retaliatory attacks specifically directed against cities 'the choice of munitions will be determined not only by the desired effect on morale' and that 'the construction of cities under attack will determine the ratio of high explosive and incendiary munitions'.⁴⁴ Since the Spanish Civil War it had been known that 'in a war in Europe, cities can be set ablaze by incendiary bombs'.⁴⁵ Because of the uncontrollable ballistics of the incendiary bombs the pathfinders had to fly their mission at low altitudes, especially when beyond the range of radio navigation systems.

The theoretical discussion of the attitude of the Luftwaffe leadership to indiscriminate bombing must now be evaluated against its practical implementation. In the Air Fleet 2 (Luftflotte 2) map exercise of 2 May 1939, which dealt with air warfare against Britain, a division commander and the Commander of the Second Air Force, General Felmy, considered a terror attack on London. If ordered, said Felmy, he would execute it. But he himself finally dismissed such an operation for reasons of adverse political and propaganda consequences. He did not give any humanitarian reasons.⁴⁶ In its final critique of this map exercise, the Luftwaffe General Staff did not accept the terror bombing concept discussed in the map exercise either. 'The noticeable progress of the English air defence and its deployment especially in the vicinity of London would mean attacking the strongest point of the enemy. It even appears doubtful that effects of catastrophic magnitude in the capital could gain enough importance to decide the war. In view of the tenacious mentality of the British, there is a much greater probability that this would even produce an undesirable enhancement of the national will to resist to the utmost'.⁴⁷ Again, the analysis of the anticipated effects played a primary role, and humanitarian aspects were ignored. However, from a formal point of view this position was not contrary to the Luftwaffe leadership's attitude

on terror bombing, which conformed to international law.

The operating procedures in force for the Luftwaffe at the beginning of the war in 1939⁴⁸ prohibited any crossing of borders by aircraft in the western theatre, except for reconnaissance purposes, and complied strictly with the provisions of international law. The air raid on Warsaw planned for the first day of the campaign against Poland, but cancelled because of the weather, aimed at targets of military importance in the city, that is, military, industrial and logistical targets.⁴⁹ The later attacks, leading to the surrender of the city, were conducted after advance warning, after demanding surrender five times, and against a defended city in the Army area of operations, and were thus in accordance with the Hague Convention.⁵⁰ Noble Frankland, co-author of the work on strategic bombing operations against Germany, equates the bombing of Warsaw with that of Rotterdam, saying 'these attacks were within battle zones and their object was to bring about the surrender of the military garrisons in those towns.'⁵¹ The French Air Force Attaché in Warsaw confirmed to his government on 14 September 1939 'that the German Air Force has acted in accordance with the laws of warfare [and] attacked military targets only', therefore giving no reason for French reprisals.⁵²

An order from General von Richthofen on 11 September 1939 to bomb the Warsaw Ghetto was changed without authorisation by the executing Geschwader commander, with the backing of his Gruppen commanders, to a raid on an important military target in Warsaw. All Richthofen did was to relieve the Geschwader commander of his command. A request from von Richthofen on 22 September 1939 for a terror and devastation raid on the city and the population of Warsaw was rejected.⁵³ However, it cannot be denied that the air raids on Warsaw, which began on 24 September 1939 as preparation for the capture of the city, and which reached their climax on 25 September, had the character of terror attacks, because they were, in part, carried out using Ju 52 transport planes that were unsuitable for aimed bomb-dropping. The incendiaries, amounting to one-seventh of the total amount of bombs dropped, had therefore to be shovelled out of these planes using coal shovels.

The bombing of Rotterdam on 14 May 1940 was an attack on a defended part of that city within the front-line area. The Germans tried to recall the two attacking bomber formations when the Dutch defenders showed their willingness to surrender. However, only one of the two Gruppen saw the red flares and

returned to base with its bombs. In order to avoid damaging those parts of the city which were not defended the bombers flew at an altitude of only 750 metres, thus deliberately exposing themselves to enemy ground defences. Only high-explosive bombs and no incendiaries were dropped, but large amounts of lubricants and fats stored in warehouses caused heavy blazes. Under the seemingly false impression that the Dutch were using delaying tactics, and in view of the time-pressure (all of France had still to be conquered; hitherto the advance had been slow and the enemy lines near Sedan had not yet been penetrated) it was possibly thought that the situation in the rear would have to be clarified rapidly.

The Chief of the Operations Department of the Luftwaffe Operations Staff, Colonel Hoffmann von Waldau, later wrote in his diary: 'Even after [our] tanks had arrived, British pressure led to tougher resistance, mainly in Rotterdam. What remained was the radical solution to break it by air attack.' A later entry indicating that south Rotterdam was as devastated as Warsaw, that the resistance in Rotterdam had been eliminated, and the 'Holland Case' had been solved because of the imminent surrender of Holland, does not change the nature of this air raid as it was described.

Neither were the strategic bombing raids of 2 and 3 June 1940 on airports, the aircraft industry near Paris, and the port of Marseilles (to cut off supplies from Northern Africa) terror attacks.⁵⁴ They were aimed at military targets and not at residential areas. A diary entry by the Chief of the Operations Department of the Luftwaffe General Staff, Colonel Hoffmann von Waldau, saying that the attack on targets near Paris had been a 'strike prepared with loving care' with the intention of achieving a 'desirable influence on the morale of the capital', is not at odds with the above objective, and is no proof of any deliberate intention to terrorise the French civilian population. One only has to read the entire entry,⁵⁵ expressing firstly the aim of paralysing the French Air Force and, secondly, the destruction of the French engine and aircraft industry, to realise that the targets of these air raids were of direct military importance and that the psychological effect of demoralisation was only a secondary effect of the destruction of these military and industrial targets. The choice of words is indeed somewhat strange, but nothing extraordinary in wartime, apparently reflecting pride in military professionalism mixed with a certain frivolity that, unfortunately, develops in times of war.

Likewise, Hitler's instructions for the air operations which he ordered in Directive No. 13 of 24 May 1940, in reaction to the 'English attacks on the Ruhr'⁵⁶ do not prove that terror bombings were to be conducted from then on.⁵⁷ This could be assumed if only the statements to the effect that operations against the English heartland were now 'authorised without restrictions' and to be initiated 'with a devastating retaliatory attack' were considered. The term 'retaliatory attack' expressly specifies that this was to be a limited action to put an end to the bombardments of the Ruhr, and not continuous terror bombing.

Regarding the further conduct of air operations and targets the directive also made reference to the 'guidelines contained in Directive No. 9 and the supplements to be published by the Armed Forces High Command'. Directive No. 9 of 29 November 1939 lists the following targets: major ports, mining of access routes; merchant marine and navy vessels, warehouses, cold-storage warehouses, troop and supply trains; aircraft, armament and ammunition industries. The supplements of the OKW, dated 26 May 1940, do not deviate from this target list and emphasise the particular importance of the aircraft industry and utilities. The air raids on the English heartland were to begin only as 'adequate forces became available', which was expected to be the case about seven weeks after the conclusion of the campaign against France, while Bomber Command continued to bomb targets in Germany with very little accuracy.⁵⁸

German air raids were initially directed against shipping to and from Britain and from the beginning of August 1940 against military and, above all, air-force armament industries near the coast and in south-eastern Britain. These were still daytime raids – and air raids under conditions of improper visibility on London had been prohibited by executive order of the Führer. As a result, on 13 and 18 August 1940, bomber formations whose targets were covered by a solid layer of cloud returned home with their bomb-loads. The relevant order from the Führer was only withdrawn on 4 September 1940.⁵⁹ Instead, the Interim Tactical Guidelines for Air Force Operations against Britain, of 18 January 1940,⁶⁰ were applied. They specified that combat operations would 'always be directed against designated targets only' and unauthorised attacks by crews were to be punished most severely, as they might provoke 'enemy reaction with negative consequences for their own conduct of the war'.⁶¹ Within the Air Force expedience took priority over the humanitarian view. Nevertheless, there are reports of German bomber

crews being court-martialled for disobeying their orders and dropping their bombs on residential areas in Liverpool, as later aerial photographs showed.⁶² For practical purposes, such restrictive orders were surely unrealistic, but certainly less so than the corresponding British ones, because the latter referred to night attacks, while in the summer of 1940 the Luftwaffe was still attacking during the day. All in all, Germany did not conduct independent air raids on the English hinterland before the end of July 1940. Hitler apparently still hoped for a reconciliation with Britain and wanted, also in the opinion of the British, a limitation of bomb warfare to the battle zones on the ground, and no strategic and terror bombings.⁶³

In August and September 1940 the Germans⁶⁴ also considered the possibility of bombing English cities⁶⁵ and the civilian population to instigate uprisings of the 'lackadaisical' workers against their government and the ruling class⁶⁶ and to trigger mass panic, which would congest the supply routes to the planned invasion area. For weeks, Luftwaffe staff and subordinate headquarters had also considered air raids on the British capital.⁶⁷ The situation seemed to be favourable for such an escalation because of the intensification of air warfare on both sides after the night of 24 August 1940, when a few German bombers accidentally dropped bombs on London. There are reports that the crews were punished for their act,⁶⁸ since London was still excluded from bombing by order of the Führer and in accordance with a directive issued by Goering. In the situation report of the Luftwaffe Operations Staff Ic of 25 August 1940,⁶⁹ London is not mentioned as a target, while all attacks conducted that night are described in great detail. This would indicate that London had not been a target and that the bombing must have been accidental. Accordingly, *The Times* reported in its first issue after the incident, on Monday 26 August 1940 that 'the damage was very small indeed',⁷⁰ and official publications in England confirm that this was an accidental bombing by up to 12 German bombers, and not a large-scale raid.⁷¹ This conclusion sounds logical, the more so if one compares the 76 incidents caused that night by the bombing with the approximately 1,500 minor incidents, eleven large fires, and 6 blazes caused by the raid on the British capital by 136 Luftwaffe bombers on 29 December 1940.⁷² The generally accepted view that the former was an accidental minor attack was confirmed again by Tress in his paper quoted here.

This incident prompted British bombing raids on Berlin,

which Hitler answered, as Churchill had expected and desired, by authorising London as a target for German bombing, starting on 7 September 1940. His speech of 4 September 1940, after repeated British bomber raids on Berlin, in which he said he would have English cities 'erased',⁷³ seemed to mark the transition to terror bombing. In fact, however, in Directive No. 17 of 1 August 1940 he continued to reserve the right to order terror raids;⁷⁴ and on 14 September 1940, ten days after this blood-thirsty speech, he rejected the proposal of the Luftwaffe Chief of the General Staff, Jeschonnek, to bomb English residential areas to trigger mass panic among the civilian population, saying 'Yes, but the attack on installations of military importance is always the most important point, because it destroys irreplaceable property. As long as there is one remaining target of military importance it must not be let go.'⁷⁵ He ordered that 'although the target area has been extended, air raids on London will continue to be directed primarily against installations of military importance and vital facilities in the city, including train stations. Terror raids on purely residential areas should only be a last resort to exert pressure and, therefore, should not be used at this time.'⁷⁶ This apparently related to terror bombing as a continuous mode of operation. Mission orders, for example, for II Gruppe, Bomber Geschwader 76, continued to list as targets the air force and air-force armament installations and lines of communication of military value only.⁷⁷ Initially, only the first deliberate raid on London on 7 September 1940 had been declared a retaliatory attack, and – as Liddell-Hart states – with full justification.⁷⁸ Of the further attacks conducted as part of the German night-time air offensive on the British armament industry, the attacks on London of 16 and 19 April 1941 and 10 May 1941 were designated as retaliatory attacks. In addition, there were several other retaliatory attacks in the same period on other British cities.⁷⁹

In the early autumn of 1940, and in spite of a variety of other considerations, the Luftwaffe endeavoured to bomb only targets of military importance. The so-called night-time nuisance raids, whose purpose was to 'keep people from resting', were to attack air-force and similar targets, thereby affecting the population only indirectly. Attacks on industrial targets which were hard to hit because of their location or the weather, were even to be conducted by single planes manned by top-notch crews⁸⁰ to 'avoid, for the time being, major losses among the population'.

With the transition to massive night-time raids on industrial

targets in major British cities, such as Belfast, Birmingham, Bristol, Chatham, Coventry, Derby, Glasgow, Hull, Leeds, Liverpool, London, Manchester, Newcastle, Sheffield, Swansea, Wolverhampton and the ports in southern Britain, dictated by British air defence in the late autumn of 1940, the German air offensive, judging by its effects, to some extent assumed the character of indiscriminate bombing, because discrimination between military and industrial targets and civilian residential areas was hardly, if at all, possible, even on clear nights and despite the use of radio navigation and dead reckoning. Civilian casualties were now being accepted to a larger extent. Particular significance was attained by the night-time raid on Coventry on 14 November 1940, described in the German target list as 'Little Essen'.⁸¹ The target folder⁸² listed 17 aircraft-engine and other armament factories scattered throughout residential areas in the whole city, whose civilian population was therefore badly hit. The situation report of the Luftwaffe Operations Staff Ic on this 'large-scale attack on Coventry', designed to cripple this 'centre of the aircraft industry', says that 'effects on such a scale have not been observed before' and 'that the objective of this attack . . . has been achieved'.⁸³ In Britain at the next day's War Cabinet meeting, the Lord President of the Council called it 'the heaviest [raid] yet experienced on a munition centre'. After the war, it was described as 'a legitimate operation of war' which had been presented by wartime propaganda 'as a "terror attack" on civilians, and had a dramatic effect on British, and indeed world public opinion'.⁸⁴

From the reference file of directives and orders for the attack on targets in Britain by bomber formations between August 1940 and July 1941⁸⁵ it appears that these attacks, like all others except the retaliatory attacks on London, were intended for military and industrial targets. The summaries of the results of the bomber operations against Britain contained in the daily situation reports of the Intelligence Department of the Luftwaffe Operations Staff⁸⁶ confirm this by describing the effects on the targets. With respect to the effects, it is not unusual to find notes saying that the bombs had to be dropped through the clouds by radio navigation or dead reckoning because of limited visibility, and that the effects could not be observed for the same reason. Radio navigation, which was soon jammed, although not rendered completely ineffective, was, as already stated, not accurate to within 100 m. The situation reports frequently mention large fires in some parts of cities and rows of streets set

ablaze,⁸⁷ thus indicating that civilian residential areas were affected.

In a study written as late as 1944 at the Air Force Academy entitled *Luftwaffe Operations Against Britain, its Tactics and Lessons Learned, 1940-43*,⁸⁸ it is said that the raids on London 'also marked the beginning of the air war against industrial resources with full force and at the same time it put the morale of the civilian population to a severe test'. The latter statement, however, is left unsubstantiated, so one cannot tell whether deliberate attacks on the morale of the Londoners are meant. The effects of the German night-bomber offensive on the British war economy in the winter and spring of 1940-1 are, however, not quite clear. Since the texts of the orders to attack given to the German bomber units involved in these operations are no longer available, only the titles, we cannot verify the purpose of each attack. But, once again, the collection of titles of orders to attack and the after-action reports contained in the daily situation report of the Ic of the Luftwaffe Operations Staff refer exclusively to targets of military significance, with the exception of retaliatory attacks, which means that the Luftwaffe in the winter of 1940/41 did not intend to engage in air warfare in the form of terror bombing. With the explicit designation of the last large-scale attack on London on 10/11 May 1941 as a retaliatory attack marking the end of the offensive on industrial targets, which was discontinued because of the impending war in the East, the Germans stated once again that indiscriminate bombing should remain a reprisal and should not be pursued, in this one case for very obvious reasons. It cannot be denied that, in practice, the German air raids on Britain assumed an indiscriminate nature, and that the terrorisation of the civilian population was accepted as a not unwelcome side-effect.⁸⁹

In reality, despite some emotional claims and wishful thinking on the part of Hitler and the Luftwaffe leadership, operations against the British armament industry and thus indirectly against the morale of the civilian population were no longer considered decisive to the war even by late 1940.⁹⁰ This was clearly stated in Hitler's Directive No. 23, 'Guidelines for Warfare against the British Defence Industry', dated 6 February 1941.⁹¹ It discarded 'earlier ideas' that the best way to hit Britain would be to destroy its armament industry, thereby breaking its will to resist. 'The direct effects of the air raids on the armament industry', it read, 'are hard to assess The least noticeable aspect to date is the effect on the morale and resistance of the

British people.' Priority in air operations was therefore shifted to 'operations against enemy lines of supply', that means, to bombing merchant ships and ports, which did not preclude additional attacks on the air-force armament industry. In any case, 'no decisive success' was to be expected of 'deliberate terror raids on residential areas'.

The most obvious proof that the Luftwaffe, as late as 1941, was still not emphasising terror bombing but seeking to destroy targets of military importance with foreseeable effects on the war effort is given by those affected by the German bombing warfare of that time. The official British work on British air defence during the Second World War makes the following comments on the German bomber operations against Britain in those days:

Although the plan adopted by the Luftwaffe early in September had mentioned attacks on the population of large cities, detailed records of the raids made during the autumn and winter of 1940-1941 do not suggest that indiscriminate bombing of civilians was intended. The points of aim selected were largely factories and docks. Other objectives specifically allotted to bomber crews included the City of London and the government quarter around Whitehall.⁹²

In view of the reference to 'large cities' and its place directly under the chapter entitled 'The Night Offensive against British Industry and Communications', separated from it by just a small paragraph, it can only be assumed that this applies not only to London but to all other cities in which targets were attacked by the Luftwaffe between November 1940 and May 1941. But not only the historian arrived at that conclusion; the British Secretary of Aviation, Sinclair, made this evaluation as early as 1941 - as can be read in the memoirs of General Arnold, Chief of Staff of the American Army Air Forces staying in London at that time with a delegation of observers.⁹³ 'Sinclair', he writes, 'took me to the Air Raid Precaution Office where there was a map of the city showing the location of all the bombs that had been dropped. They were spread all over London, in most cases close to railroad stations, switching points, power houses, transformers, bridges, docks, warehouses and factories; but a lot were in the residential districts. Every bomb dropped was accurately plotted.'

And finally, the air raid of 6 April 1941 on Belgrade was not a terror attack, and certainly not an attack on an open city. In his

biography of Löhr,⁹⁴ Colonel Diakow (ret.) recounts how the Commander-in-Chief of the 4th Air Fleet, Löhr, changed Hitler's order to destroy the city into an attack on military targets and targets of military importance. The attack was on military barracks and camps, supply and traffic centres, air bases, air-defence positions, government and military headquarters and the royal palace in Belgrade. This was verified by a group of experts dispatched to Belgrade by the Director-General of Luftwaffe Armament to analyse the effects of the 218.5 tons of bombs dropped on the city that day.⁹⁵ Nevertheless, it must be admitted that the city was hit also in other places, that some of the bomb drops were indiscriminate, and that there are still some open questions about this air attack. At Nuremberg, no Luftwaffe leader was charged and convicted because of Warsaw, Rotterdam, Coventry and Belgrade, nor was German air warfare condemned as a whole.⁹⁶

Summarising the phase of the German night-time air offensive against the British armament industry, which lasted until mid-May 1941 and represented the first independent strategic bomber operation in history, it can be said that it began only four months after the beginning of the British bomber offensive which was intended to hit targets of military significance but actually hit German cities at random and in an unco-ordinated fashion, and – with the exception of the retaliatory strikes carried out on the grounds of the right to retaliate – that this offensive was intended for and aimed at military targets and legitimate armament-industry targets, while there are indications that the British Air Staff was already on the way, in July 1940, to adopting terror bombing as a permanent strategy. This became manifest for the first time in the terror raid on Mannheim on 16 December 1940.

In view of the 41,987 civilians⁹⁷ killed in air raids in Britain – a fact of which the Luftwaffe leadership must have had at least some knowledge – one must doubt the intention of the German leadership to comply with the rules of international law on air warfare, because they too must have realised that there was no way of distinguishing between 'permissible' and 'non-permissible' bombing, and that the distinction between 'legitimate' military attacks and retaliatory attacks based on the right to take reprisals was becoming increasingly blurred in view of the effects of night bombing. Repeated recourse to the long-redundant legal instrument of reprisals, rendered ineffective by excessive use, does not, however, appear to have been mere

cynicism or concealment of the real nature of the bomb warfare, but actually corresponded to the kind of air warfare intended. Not only has this been confirmed by the British assessments quoted above, but since the Luftwaffe leadership knew that the war in the East was imminent, it was quite logical to avoid going to extremes in the West, that is, to conduct the air war in the West in accordance with rules of international law and to force the enemy to desist from his kind of strategic bombing by repeated recourse to reprisals.

However, the recourse to reprisals as a legal instrument of international law recommended by some as a cover and excuse for 'moral' bombing became untenable at the very latest with the declaration by the British Government on 18 April 1941, which made the following comments about a British air raid on Berlin: 'It is not a reprisal, but part of the regular policy adopted by the RAF under instructions of His Majesty's Government of bombing all objectives in the two guilty countries [Germany and Italy] which are most likely to weaken their military and industrial capacity. This policy will be continued to the end of the war, it is hoped on an ever-increasing scale, irrespective of whether any further attacks are made on the British Isles or not.'⁹⁸ Bomber Command was, at the time, the only weapon with which Britain could strike back directly against Germany.

It was only in the spring of 1942, after the destruction of the historical centres of Lübeck and Rostock by area bombardments of the RAF Bomber Command, that the Luftwaffe deliberately resorted to several months of indiscriminate bombings with its so-called 'Baedeker' (tourist-guide) attacks on historical British cities, such as Bath, York, Canterbury and so on. However, these were carried out with insufficient forces, as most of the bombers were committed in Russia and the Mediterranean. It was obvious that these attacks would also be declared as reprisals,⁹⁹ thus asking the British enemy to discontinue his bombing operations, because the Luftwaffe for its part could not go through a prolonged period of indiscriminate bombing, simply because of a lack of resources.

It is clear that these attacks – despite their ineffectiveness, despite the realisation that they had better not be undertaken because of the cultural nature of the targets and their negative impact on morale, and despite the claimed recourse to the right of reprisals – represented a change of attitude in the Luftwaffe General Staff, substantiated by their decision, taken after the British air raids on Lübeck and Rostock, to go back on their

decision of 1939 on the engagement of area targets, and their demand that the Generalluftzeugmeister (Director-General of Air Armament) should submit an appropriate project. This became known later as the flying bomb, the V 1.¹⁰⁰

From the above it appears that the Luftwaffe did not resort to deliberate¹⁰¹ and full-scale indiscriminate bombing until 1944, after Hitler had for a long time demanded the breaking of terror by counter-terror.¹⁰² These operations, which were nothing but a helpless lashing out to spread fear and terror, were also declared as retaliatory raids. However, because of the unaimed shots and their long duration they cannot be regarded as reprisals in the sense of international law. In view of Hitler's ever-increasing infuriated demands to break the air terror by counter-terror it was a good thing that he no longer had the means to do so.

Finally, one can say that the Luftwaffe resorted to intentional indiscriminate bombing as a general method for the first time in the spring of 1942, and then on a full scale in summer 1944 with the employment of the V 1 against Britain. This was the kind of air war which Hitler, Goering, and some air and party leaders and NS-propagandists privately would have wished for much earlier, and which was inherent in the theory of total war. Besides, it continued to abide by the rules of air warfare and attack military and industrial targets. The latter can be attributed to doctrine, economics and expediency, but also to humanitarian considerations, which, however, were rated lower than the exigencies of war, as was the case elsewhere too. The reasons for indiscriminate bombing lay in the existing theoretical pattern of total war just mentioned, in the vagueness of definitions of what military targets were in industrialised societies, in Hitler's social-Darwinist belief, in the preceding British indiscriminate bombings, and in the failure of the German bomber force, which cleared the way for the alternative, that is, the continuation of bombings with the indiscriminate use of the V weapons. While hits on military and industrial targets were initially intended and attempted as a rule on both sides, this could frequently not be recognised as such by those affected by the bombings, and this, in turn, was another important reason that, in practice and also by popular pressure, led to the perversion of the bombing war, to the escalation of violence and to considerable civilian losses.

Notes

1. To do this *sine ira et studio* is intended here. It is not intended to attempt with retrospective obstinacy an assessment of guilt. One should not forget that Hitler's Germany began the war and that the bomber forces of Germany and Britain had to fulfil different tasks in the given geostrategic situation, and were thus confronted with different problems awaiting a solution; also that Bomber Command was for a long time the only means of the British to hit back at Germany directly.
2. As did the Luftwaffe in para. 12 of Luftwaffendienstvorschrift 16 'Luftkriegführung' (L.Dv. 16 – the form of abbreviation used to refer to this document hereafter).
3. Eberhard Spetzler, *Luftkrieg und Menschlichkeit*, Göttingen, etc., 1956, p. 232.
4. *Ibid.*, p. 160.
5. Cf. *ibid.*, p. 232 f.; David Irving, *Von Guernica bis Vietnam. Die Leiden der Zivilbevölkerung im modernen Krieg*, Munich, 1982, p. 48 f.
6. As stated by Spetzler in *Luftkrieg und Menschlichkeit*, p. 222 f., the law of air warfare in effect in 1939 prohibited, as far as the civilian population was concerned, attacks with outlawed weapons (gas, bacteria, dum dum bullets, etc.); direct attacks on buildings protected by Art. 27 of the Hague Convention on Land Warfare (cultural monuments, health-service buildings, and welfare, art, scientific and religious buildings not used for military purposes) if they could be avoided; attacks in support of the ground battle during the seizure of undefended settlements (defended ones may be bombed); attacks on persons abstaining from hostile activities (except when fighting for defended settlements and as an exigency of war, a condition not fulfilled by terror attacks); and indirect harming of civilians and their property during legitimate attacks on military targets, if avoidable or in no way commensurate with the success achieved against the military target. The primary justification for ignoring these principles was essentially only the right to take recourse to reprisals, which is linked to the rule of commensurateness with the cause and designed to make the opponent desist from his illegitimate action. The Hague Rules of Air Warfare of 1923, which would have restricted bombing significantly, were never ratified, and thus never became binding as international law, although as a manifestation of 'common law' they greatly determined the conduct of the air powers prior to the Second World War (Spetzler, *Luftkrieg und Menschlichkeit*, p. 156 f.). In the war environment they did not any longer receive the attention due to them. Cf. Julius Stone, *Legal Controls of International Conflict*, New York, 1954, pp. 608–631.
7. Helmut Groscurth, *Tagebücher eines Abwehroffiziers*, Stuttgart, 1970, p. 385.
8. Klaus Maier, in Militärgeschichtliches Forschungsamt (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, Stuttgart, 1979, pp. 43–69. The OKW study of 19 April 1938 referenced here cannot be construed to prove the intention of indiscriminate bombing (Horst Boog, *Die deutsche Luftwaffenführung*, Stuttgart, 1982, pp. 153 ff).
9. Bernhard Kroener and Rolf Dieter Müller, in Militärgeschichtliches Forschungsamt (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 5,

- Stuttgart, 1988; Heinz Boberach, (ed.) *Meldungen aus dem Reich, 1930-45*, Vols 1-17, Herrsching, 1984-5.
10. Spetzler, *Luftkrieg und Menschlichkeit*, p. 161, p. 267 f.; Oswald Hauser, *England und das Dritte Reich*, Stuttgart, etc., 1972-82, Vol. 1, p. 145.
11. See e.g. Alfred Kube, *Pour-le-Mérite und Hakenkreuz. Hermann Göring im Dritten Reich*, Munich, 1986, pp. 208, 210.
12. Klaus A. Maier, in: Militärgeschichtliches Forschungsamt (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, pp. 56, 66 f., 103 f., 151 f. The terror theory has recently been refuted by Hans-Henning Abendroth in his article 'Guernica: Ein fragwürdiges Symbol', *Militärgeschichtliche Mitteilungen* (hereafter MGM), 41, 1987, pp. 121, 123.
13. Geoffrey Best, *Humanity in Warfare*, London, 1980, p. 278.
14. See Horst Boog, 'Das Offizierkorps der Luftwaffe 1935-1945', in Hanns Hubert Hofmann (ed.), *Das deutsche Offizierkorps 1860-1960*, Boppard am Rhein, 1980, p. 324 f., and Boog, *Luftwaffenführung*, pp. 322 f., 470, 530. The officer corps of the Luftwaffe, being only a few years old, was initially not homogeneous enough to develop a unified tradition. Thus they still lacked the *esprit de corps* and cohesion initially found in the Army officer corps, which was necessary to take a firm stance against National Socialism. On the other hand, the Luftwaffe officer corps, unlike the Navy officer corps, did not suffer from the 'trauma of 1918', which contributed to the political motivation of endurance at any cost. In the Luftwaffe, as the service using more technology than the other services, the primary objective was to ensure that technology would work. Politically, GAF Officers were therefore much more indifferent than officers of the other services. And they could afford this, since their political top leaders, personified by Goering and Milch, did not display any internal political zeal, and thus provided a shield. Until the very end the General Staff successfully resisted the notion of giving the Nazi political control officer the status of a chief of staff. Thus, the Luftwaffe had officers of the most varied political affiliations, including people like General Dr Knauss, who assumed an attitude of 'internal emigration' upon entering the Luftwaffe.
15. For example, the message of Luftflottenkommando 3, Staff Section III, 6 Sep. 1939 to Air Divisions 5 and 6 and Luftgaukommando VII, XII, XIII, in Bundesarchiv-Militärarchiv, (hereafter BA-MA), RL 7/298.
16. *Ibid.*, pp. 3, 99.
17. Boog, *Luftwaffenführung*, p. 384.
18. Appendix 1 to Vol. 1, 'Planstudie 1939'. BA-MARL 2 II/1; Klaus A. Maier, in Militärgeschichtliches Forschungsamt (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, p. 62; Boog, *Luftwaffenführung*, p. 185.
19. See appendix 2 of RdLuObdL Genst. 3. (takt.) Abt. (I) Nr. 230/39 g.Kdos., V. Ang. of 29 June 1939, BA-MA RL 7/160, and *Einsatz gegen England*, Der Reichsminister der Luftfahrt und Oberbefehlshaber der Luftwaffe (DRdLuObdL) General Staff 1 Abt. No. 68/48 g. Kdos. (III), 10 Jan. 1940, p. 2: 'One aircraft too many means an uneconomical mission', BA-MARL 2, II/368.
20. This understanding may be that of the traditional monarchic state and social order, in which the military supported the monarchy; whereas, in a democracy, the people are the sovereign on which the government depends and whose morale thus becomes a primary target, as expressed in

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the RAF War Manual, Part I, 'Operations'.

21. Cf. Edward L. Homze, *Arming the Luftwaffe*, Lincoln, Nebraska, and London, 1976, p. 122; Boog, *Luftwaffenführung*, p. 164.
22. See para 12, L.Dv. 16.
23. See Pohle, Hptm. i G.: '1-1462/39-C, Kdos, Presentation - during the General Staff Ride of June 1939', copy, pp. 13 f., 24 f., BA-MA Lw 104/14 Teil 1.
24. Karl-Heinz Völker, *Die deutsche Luftwaffe 1933-1939*, Stuttgart, 1967, pp. 207; Boog, *Luftwaffenführung*, pp. 183-190.
25. General der Flieger a.D. Paul Deichmann, *Die Angriffswaffen der Deutschen Luftwaffe und ihre Anwendung*, Militärgeschichtliches Forschungsamt (MGFA), Study Lw 33, p. 82: 'Before the war, Colonel Jeschonnek, Chief of the Luftwaffe General Staff, argued that, in view of the inadequacy of available sights, which made high-altitude hits very difficult, low-level and/or dive attacks would be the attack techniques of the Luftwaffe in a future war. With this he had assumed a position contrary to that of the then Inspector of Bombers, but using his leverage he ensured that his opinion prevailed.'
26. Oral information from Pohle, 2 July 1986.
27. DRdL Nr. 6893/34 g. Kdos, in BA-MARL 3/192.
28. Oberst Edgar Petersen, Commander of Luftwaffe Proving Grounds, as quoted in Boog, *Luftwaffenführung*, p. 186.
29. 'RdLuObdL L.A. Nr. 2200/37II5/Fl. In. 2g., 1 June 1937', BA-MARL 3/463.
30. Spetzler, *Luftkrieg und Menschlichkeit*, p. 226.
31. Generalleutnant (ret.) Josef Schmid comments on this in Deichmann, *Angriffswaffen*, MGFA Lw 33, p. 68 f.:

It is common knowledge that Gen Jeschonnek had promoted with all means a bomber with diving capability already before the war. He wanted to replace mass attacks with small and very small flights of 1-3 bombers to destroy key facilities of an industrial plant in a dive attack and thus render it inoperational. In this context I remember the tests made during the Battle of Britain. 'Destruction raids' were to be conducted during the day by single planes operated by highly qualified crews, exploiting bad weather, on facilities of British key industries. Despite satisfactory hits . . . it became clear that the plants resumed operation either immediately or after only a short time.

See also *Einsatz gegen England*, DRdLuObdL Generalstab 1. - Abt. Nr. 6040 g. Kdos. (III), 10 January 1940, p. 2: 'Whereas lasting damage and disruption of the target can be achieved in most instances by far smaller forces . . .', p. 4: 'Taking advantage of clouds dictates attacks by small formations', p. 18: 'The attack unit is the flight (of 3 aircraft), DObdL Führungsstab Ia Nr. 5937 g. Kdos., 2 September 1940: 'It is necessary to attack and destroy the targets during the day with single aircraft,' both in BA-MA RL 2 II/360.

32. Churchill to Portal on 14 July 1941, Lord Beaverbrook to Ministry of Defence on 29 August 1941, PRO CAB 120/292.
33. Oberstabsingenieur, a. D. Rudolf Brée, *Meine Tätigkeit Reichsluftfahrtministerium 1935/45 unter besonderer Berücksichtigung der Entwicklung ferngelenkter Körper*, report of April 1987, p. 1 (encl. to Brée's letter to the author, 22 May 1987).

- Brée was the chief of the department of the Technical Office of the General-luftzeugmeister responsible for the research and development of missiles. See also Pohle, *Presentation*, p. 24 f., BA-MA, Lw104/14 Teil 1. He specifically describes point targets as the objective of bomb development, while reducing the total number of bombs needed and simultaneously improving them.
34. Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, Vol. I, London, 1961, pp. 114, 204.
 35. L.A. (NVW) IIIA 2 Nr. 941/36 g. Kdos., 6 Mar. 1936, BA-MARL 3/192. See also Pohle, *Presentation*, p. 23 f., BA-MA Lw 184/14 Teil 1. On pre-war development cf. also Forschungsplan RLM 1938, 3. Teil: Ausrüstung, Nr. 30300, 30413, 30500', in BA-MA RL 39/1034, and 'Tätigkeitsbericht der Luftfahrtforschungsanstalten und -institute des RLM', finished in Dec. 1940, p. 27, in BA-MA RL 3/2368.
 36. On this development, see Fritz Trenkle, *Die deutschen Funk-Navigations- und Funkführungsverfahren bis 1945*, Stuttgart, 1979, pp. 58, 149; Alfred Price, *Herrschaft über die Nacht. Spione jagen Radar*, Gütersloh, 1968, pp. 35-55; Werner Niehaus, *Die Radarschlacht 1939-45*, Stuttgart, 1977; Ulf Balke, *Kampfgeschwader 100 'Wiking'*, Stuttgart, 1981; R. V. Jones, *Most Secret War*, London, 1978, pp. 84, 135, 140, 164; Fritz Trenkle, *Deutsche Ortungs- und Navigationsanlagen (Land und See 1939-1945)*, ed. Leo Brandt, Düsseldorf, 1964, p. 67; Hinsley, *British Intelligence*, Vol. 1, p. 556.
 37. Niehaus, *Radarschlacht*, pp. 56-8; Price, *Herrschaft über die Nacht*, pp. 20-42, 51, 77, 80, 118, 112, 288; Trenkle, *Funk-Navigations- und Funkführungsverfahren*, pp. 56, 66, 94, 152; Jones, *Most Secret War*, pp. 92-105, 127; Trenkle, *Ortungs- und Navigationsanlagen*, p. 74; Hinsley, *British Intelligence*, Vol. 1, pp. 550-6.
 38. Niehaus, *Radarschlacht*, p. 69; Jones, *Most Secret War*, pp. 172-8; Trenkle, *Funk-Navigations- und Funkführungsverfahren*, pp. 68 ff, 156; Trenkle, *Ortungs- und Navigationsverfahren*, p. 73. Jamming could repeatedly be overcome, at least partially, as shown in document 'Luftflottenkommando 3 Führ./Abt. Ia op 1 Nr. 4784/42 g. Kdos., 21 May 1942: Bezug: Rücksprache Generaloberst Jeschonnek - Staatsrat Plendl, an Chef Genst. d. Lw.', BA-MARL 7/295; Hinsley, *British Intelligence*, Vol. 1, pp. 559 ff.
 39. Cf. Klaus Maier, in *Militärgeschichtliches Forschungsamt* (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. II, pp. 387 ff; Boog, *Luftwaffenführung*, p. 104.
 40. Brigadier General (Bundeswehr) (retd) Rudolf Friedrich when interviewed by the author on 26 Nov. 1986 in Bonn. Friedrich was the Ia Op 1 Officer in the Luftwaffe General Staff Operations Section in 1940-1.
 41. II/KG 76 Abt. Ia Nr. 1357/48 g. 4 Oct. 1940: Kampfaufträge für Störangriffe auf Loge; Message ObdL FüSt Ia (Robinson) Nr. 6685/41 g (II), 15 Feb. 1941; ObdL FüSt Ia Nr. 50/41 g (II), 6 Jan. 1941, subj.: Vorbereitung und Durchführung von Feindflügen, all in BA-MA RL 2 II II/368; Luftflottenkommando 3 FüAbt./ Ia Op 1 Nr. 4784/42 gK of 21 May 1942, in BA-MARL 7/295.
 42. Hans Rumpf, *Das warder Bombenkrieg. Deutsche Städte im Feuersturm*, Oldenburg, 1961, p. 68 f.; Theo Weber, *Die Luftschlacht um England*, Wiesbaden, 1956, pp. 165, 173; BA-MA RL 2 IV/33.

43. Arthur T. Harris, *Bomber Offensive*, London, 1947, p. 83.
44. L.Dv. 16, para 47., para 189.
45. 'Erfahrungsbericht der Legion Condor über den Einsatz der Kampfflieger', signed by Cpt. von Knauer (excerpt), in Klaus A. Maier, *Guernica* 26.4.1937, Freiburg, 1975, p. 153. Message, ObdL Führungsstab Ia (Robinson) to Lfl 3, info Lfl 2, Kurfürst Ia, 15 Feb 1941, BA-MA RL 2 II/368.
46. Debriefing of 1939 Map Exercise, Luftflottenkommando 2, FüAbt. Nr. 7093/39 g, Kdos. Chefs Braunschweig, 13 May 1939, BA-MARL 7/42.
47. 'Operative Zielsetzung für die Luftwaffe im Fall eines Krieges gegen England im Jahre 1939', Generalstab 1. Abt. (Chef) Nr. 5894/39 g, Kdos. Chef-Sache, 22 May 1939, MGFA Sammlung Greffrath G IV/1.
48. Cf. Planstudie 1939, Vols I-III, BA-MARL 2 II/1-3.; Spetzler, *Luftkrieg und Menschlichkeit*, p. 259 f.
49. General der Flieger (ret'd) Wilhelm Speidel, *Die Luftwaffe im Polenfeldzug*, MGFA Studie Lw 2a, pp. 24, 381 f.
50. Spetzler, *Luftkrieg und Menschlichkeit*, p. 235; Kesselring, in *Der Prozess gegen die Hauptkriegsverbrecher vor dem Internationalen Militärgerichtshof, Nürnberg, 14. Nov. 1945-1. Okt. 1946*, 42 Vols., Nürnberg, 1947-1949 (hereafter IMT), Vol. 9, p. 199 f.; Speidel, *Luftwaffe im Polenfeldzug*, pp. 471, 327.
51. Noble Frankland, *The Bombing Offensive Against Germany*, London, 1965, p. 111 f.
52. IMT, Vol. 9, p. 759.
53. Speidel, *Luftwaffe im Polenfeldzug*, p. 328.
54. On Hoffmann von Waldau and Rotterdam, see Personal war diary of Luftwaffe General Otto Hoffmann von Waldau, BA-MARL 200/17, p. 6 f.; cf. Spetzler, *Luftkrieg und Menschlichkeit*, p. 249 f. Further on Rotterdam Hans-Adolf Jacobsen, 'Der deutsche Luftangriff auf Rotterdam (14. Mai 1940). Versuch einer Klärung', *Wehrwissenschaftliche Rundschau*, 8, 1958, No. 5, pp. 257-84; Cajus Bekker, *Angriffshöhe 4000. Ein Kriegstagebuch der deutschen Luftwaffe*, Oldenburg und Hamburg, 1964, pp. 118-36; James R. M. Butler, *Grand Strategy II*, London, 1957, p. 569 f.; Norman Longmate, *The Bombers. The RAF Offensive Against Germany*, London, 1983, p. 83; Max Hastings, *Bomber Command*, London, 1979, p. 64; Horst Boog, 'Luftwaffe Operations Against the Netherlands, 10 to 15 May 1940', in: J. P. B. Jonker, A. E. Kersten, G. N. van der Plaats (eds), *Vijftig Jaar na de Inval, 's-Gravenhage* 1990, pp. 35-40. As to the bomb mixture, see Hans Rumpf, *Das war der Bombenkrieg*, Oldenburg, 1961, p. 68. Concerning the attempt to call the bombers back see letter by Wilhelm Giesen (at that time radio operator at Quakenbrück air base) of 9 Aug. 1984, MGFA Ast. AIF III. A different opinion is held by William A. Swint, 'The German Air Attack on Rotterdam, May 14, 1940 Revisited', *Aerospace Historian*, vol. 21, No. 1, Spring/March 1974, pp. 14-22. Situation reports of the Luftwaffenführungsstab Ic Nr. 270 and 271, of 2 and 3 June 1940, in BA-MA RL 2 II/207 and 208.
55. Personal war diary of Luftwaffe General Otto Hoffmann von Waldau, BA-MA RL 200/17, p. 15.
56. *Hitlers Weisungen für die Kriegführung 1939-1945*, ed. Walther Hubatsch, Munich, 1965 (Deutschen Taschenbuchverlag, vols. 278-9), pp. 63, 46, 50.
57. That could be concluded from Gerd R. Ueberschar and Wolfram Wette, *Bomben und Legenden, Die schrittweise Aufklärung des Luftangriffs auf Freiburg*

- am 10. Mai 1940. *Ein dokumentarischer Bericht*, Freiburg, 1981, p. 70.
58. Spetzler, *Luftkrieg und Menschlichkeit*, p. 259.
59. Generalfeldmarschall Albert Kesselring, *Soldat bis zum letzten Tag*, Bonn, 1963, pp. 85, 95; Kurt von Tippelskirch, *Geschichte des Zweiten Weltkrieges*, Bonn, 1951, p. 121.
60. DRdLuObdL Generalstab 1. Abt. Nr. 68/48 g. Kdos. (III), BA-MARL 2 II/360.
61. Reichsmarschall-Conference, 15 August 1940, concerning intentional focusing on enemy air force and air-armed targets, BA-MA RL 2 II/360; Comments of the Reichsmarschall on operations, in the meeting of 19 August 1940, p. 5, BA-MA RL2 II/27 and RL 2 II/360; ObdL Führungsstab Ia Nr. 5835/40 g. Kdos. (op 1), Chef-Sache, 20 August 1948, BA-MARL 2 II/27; Adolf Galland, *Die Ersten und die Letzten*, Darmstadt, 1953, pp. 100, 113; Kesselring, *Soldat*, p. 107 f.
62. As told by Oberst a.D. Hajo Hermann, in David Irving, *Von Guernica bis Vietnam*, p. 58.
63. J. M. Spaight, *Air Power and War Rights*, 3rd edn, London, 1947, p. 267; Werner Baumbach, *Zu Spät?*, Munich, 1949, p. 86; Spetzler, *Luftkrieg und Menschlichkeit*, p. 267.
64. Here above all Hitler and Jeschonnek. See Franz Halder, *Kriegstagebuch* (War Diary), Stuttgart, 1962-4, Vol. 2, p. 99 f.; David Irving, *Die Tragödie der deutschen Luftwaffe*, Frankfurt-Berlin-Vienna 1970, p. 164; Maier, *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, pp. 380, 385, 392, 402; Boog, *Luftwaffenführung*, p. 184.
65. *Merkbuch Milch*, p. 3218, copy MGFA, note on a meeting with Goering on 19 August 1940: 'X FLK. Glasgow/ Clyde wharfs, also city. No restrictions, free. - Gen (eral) nuisance raids on industry or cities - except London for the time being.'
66. Udo Volkmann, *Die britische Luftverteidigung und die Abwehr der deutschen Luftangriffe während der 'Luftschlacht um England' bis zum Juni 1941*, Osnabrück, 1982, p. 191.
67. Maier, *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, pp. 388 f., 386.
68. Longmate, *The Bombers*, p. 87.
69. Nr. 254 BA-MA RM 7/346 and RM 7/296.
70. In Harvey B. Tress, 'Churchill, the First Berlin Raids, and the Blitz', *MGM*, 32, 1982, p. 66.
71. Basil Collier, *The Defence of the United Kingdom*, London, 1957, p. 287 f.; Butler, *Grand Strategy II*, p. 410; Best, *Humanity in Warfare*, p. 276. Only Francis K. Mason; *Battle over Britain*, London, 1969, p. 297 f., speaks of a deliberate attack by some 100 German bombers on London in the night of 24 August 1948; however, he fails to provide any proof for his opinion, which runs contrary to the facts and to contemporary literature.
72. Theo Weber, *Die Luftschlacht um England*, Wiesbaden, 1956, p. 164; Collier, *Defence of the United Kingdom*, pp. 273, 503.
73. Max Domarus, *Hitler, Reden und Proklamationen 1932-1945*, Vol. 2, *Untergang* (1939-1945), Würzburg, 1963, 1975.
74. *Hitlers Weisungen für die Kriegsführung*, p. 75 f.
75. *Halder's War Diary*, Vol. 2, p. 99 f.
76. *Halder's War Diary*, Vol. 1, p. 76.

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77. Mission orders, 17 Sept.-30 Oct. 1940, II/KG 76 Abt. Ia, Nr. 1218/40 g. 1.-7. Angelegenheit; Nr. 1357/40; Nr. 1634/40, all in BA-MA RL 2 II/360.
78. Collection of attack orders from August 1940 to June 1941, in BA-MARL 2 IV/33; Baumbach, *Zu Spät*, p. 101; James M. Spaight, *Air Power and War Rights*, 3rd edn, London, 1947, p. 53; Spetzler, *Luftkrieg und Menschlichkeit*, p. 263; B. H. Liddell-Hart, *The Revolution in Warfare*, London, 1946, p. 72.
79. BA-MA RL 2 IV/33.
80. ObdL FüSt, Ia, N4. 5937/40 g. Kdos., dated 2 Sept. 1940: 'Kampf gegen die englische Luftwaffenindustrie', p. 1, BA-MARL 2 II/360. The later General of Bombers, Generalmajor (ret.) Dietrich Peltz, who participated in the air raids on Britain in 1940-1 as a Major and Gruppenkommandeur, stressed the importance attributed at the time to this method, which was called *Zerstörungsgriff* (interview with author on 29 June 1989 in Munich).
81. Spetzler, *Luftkrieg und Menschlichkeit*, p. 264 f.; Kesselring, *Soldat*, p. 106.
82. Target Files, Coventry, BA-MA RL 2 II/863-867.
83. Nr. 436, 15 Nov. 1940, in BA-MA RM 7/354.
84. 289th Meeting of the War Cabinet, 15 Nov. 1940 at 11.45 hrs, in PRO CAB 65/10, p. 63; Longmate, *The Bombers*, p. 94. Also Weber, *Luftschlacht um England*, p. 162, says that the attack on Coventry was no terror attack but a legitimate operation. Similarly Norman Longmate, *Air Raid. The Bombing of Coventry*, 1940, London, 1976, 'Contrary to all the tales of indiscriminate bombing soon being put about, the Germans were remarkably successful in hitting their intended targets and hardly a single famous name in local industry escaped', p. 212: 'The burning down of the Cathedral made it easy to present an outstandingly successful operation of war as the ruthless devastation of the homes and holy places of a peaceful little community.'
85. BA-MA RL 2 IV/33. See also assessment of bombing effects in ObdL FüSt Ic, appendix to Nr. 1500/41 g (See/III Wi), 2. Ang., of 15 June 1941, BA-MA RL 2 II/416.
86. Nr. 330 in BA-MA RM 7/344 through Nr. 611 in BA-MA RM 7/373.
87. For example, reports by the Luftwaffe General Staff to Naval Operations Staff on 7 Nov. and 25 Nov. 1940, BA-MA RM 7/296, pp. 244, 288.
88. Written by Hauptmann Bechtle, 2 Apr. 1944, BA-MA RL 2 IV/27, p. 4.
89. As to the practical execution of the bombing raids against Britain cf. oral statement of the later General of Bombers, Generalmajor (retd.) Dietrich Peltz, Munich, 29 June 1989. BA-MARL 2 IV/33; Spaight, *Air Power and War Rights*, p. 53; Spetzler, *Luftkrieg und Menschlichkeit*, p. 266.
90. Notes on meeting of 5 Dec. 1940, in Halder's *War Diary*, Vol. 2, p. 213; Maier, in *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 2, p. 404.
91. *Hitlers Weisungen*, pp. 118 ff.
92. Collier, *Defence of the United Kingdom*, p. 261.
93. H. H. Arnold, *Global Mission*, New York, 1949, p. 227 f.
94. J. Diakow, Generaloberst Alexander Löhr. *Ein Lebensbild*, Freiburg, 1964, pp. 33-44. According to Diakow the attack order of Air Fleet 4 (Führungsabteilung Ia Nr. 1000/41 g, Kdos. of 31 March 1941 in BA-MARL 7/657), which bears Hitler's traits, was altered by Löhr personally before the operation, which was now directed against targets of a military and economic character. This is largely confirmed by the report of the expert-commission of the Director General of Air Armament (note 95 below). In

- Militärgeschichtliches Forschungsamt (ed.), *Das Deutsche Reich und der Zweite Weltkrieg*, Vol. 3, p. 458 f., the intention to declare Belgrade an open city is misinterpreted as having been a reality already. Correct in Spetzler, *Luftkrieg und Menschlichkeit*, p. 274. For a balanced and cautious view on this air attack see Karl Gundelach, *Die deutsche Luftwaffe im Mittelmeer 1940-1945*, Frankfurt am Main, 1981, pp. 168 ff.
95. LC 7 II Nr. 2550/41 g., and Luftflottenkommando 4 FüAbt Ic, of 15 April 1941, in BA-MA RL 3/2157. Spetzler, *Luftkrieg und Menschlichkeit*, p. 274. Gundelach, *Die deutsche Luftwaffe im Mittelmeer*, p. 169f., points out in how far the air attack was indiscriminate and perfidious.
 96. Spetzler, *Luftkrieg und Menschlichkeit*, p. 377.
 97. Udo Volkmann, *Britische Luftverteidigung*, p. 268.
 98. War Cabinet Defence Committee Meeting of 18 April 1941, D. O. (41) 17th meeting, PRO CAB 120/300.
 99. Spetzler, *Luftkrieg und Menschlichkeit*, pp. 298 f., 323, 377; Reichsmarschall Conference of 21 March 1942, BA-MARL 3/60, p. 5181.
 100. Brée: *Meine Tätigkeit*, p. 2.: 'In the spring [of 1942] the cities of Cologne, Rostock and Luebeck were attacked by bombers. This prompted the Luftwaffe General Staff to revise its decision of 1939 on bombing area targets. The Director-General of Air Armament was tasked to present a new project with the corresponding tactical and technical requirements. After some investigation this was done. The directive to go ahead with research and development was issued in June 1942. The project was given several code names. It was the Fi 103 ('V 1'). See also Hauptmann Otto Bechtle, 'Der Einsatz der Luftwaffe gegen England, ihre Taktik und die Lehren 1940-43', in BA-MARL 17/49, p. 15: 'A fundamental revision of Luftwaffe operations started in April 1942, when retaliatory action was demanded against the terror attacks on the Reich territory now commenced by the enemy.'
 101. See Milch, on 17 Dec. 1943, on the employment of the V-weapons in Deichmann, *Angriffswaffen*, p. 75 f.
 102. See Hitler's *Lagebesprechungen*, ed. Helmut Heiber, Stuttgart, 1962, 25 July 43, pp. 253, 296 f; and Joachim C. Fest, *Hitler, Eine Biographie*, Frankfurt-Berlin-Vienna, 1976, p. 79, where it is said that this conviction of Hitler is rooted in his experiences in the struggles of the socialist workers in Vienna before the First World War.

Richard Kohn

The four preceding chapters are shrewd in argument and interesting in their perspectives. It is impossible to do full justice to them, or to the issues they raise, in a brief treatment. But let us begin with Hays Parks, for his treatise sets the stage and establishes the legal context for the conduct of that fiercest of all air wars the world has to date experienced.

Mr Parks begins by pointing out 'a perceptible vacuum with respect to any law of war regulating aerial bombardment'. That is significant; there was no law agreed to by the warring powers regulating aerial operations nor prohibiting strategic bombardment. There were only agreements on land and naval war which might be applicable to air war, and which, in a few documents of the powers and by their initial hesitation to attack each other's cities and populations, indicate that there was an inchoate sense of the acceptable, guided more by self-interest, common sense and more than three centuries of practice in western culture, than by law.

Mr Parks' discussion makes two points familiar to us, but none the less worth while to repeat in order to understand the war. First, there was the principle of discrimination between combatants and non-combatants in the law of war – which the industrialisation and mechanisation of war hopelessly obscured, making civilians almost legitimate as combatants because they so contributed to the war – and aeroplanes could reach those civilians. Second, there existed the rule of proportionality, which Mr Parks so rightly reminds us is virtually impossible to define or describe except situationally. That is, no one can really outline it; we rely in the end on judging after the fact, or, to use an old proverb, 'I can't define it, but I know it when I see it.' And that is the problem: in the absence of law, we are reduced to analysis after the fact, basing judgement against a set of

broad, slippery concepts which evolved to cover land and naval war and which the major powers had specifically refused to bind themselves to in aerial war.

Mr Parks also points out that law and ethics are usually put into place because of the political and military interest of the belligerents, and the First World War seemed to indicate that bombing had value as a tool of disruption, destruction or demoralisation. Because aeroplanes were a technology that appeared suddenly on the world stage, the European powers, egged on by the apocalyptic vision of the air enthusiasts, foresaw only greater effectiveness from the weapon. That is, strategic air war promised to restore to war its decisiveness, its ability to produce a victory in a short time and with less destruction and human suffering than had occurred in the First World War. That the belligerents were wrong – mistaken in their judgement – is not the same as their being guilty of violating law or acting in an immoral manner.

Mr Parks concludes that '... an air planner in any nation' before the war 'would have found considerable disagreement and confusion ... and, in particular, he would not have been able to find appropriate language explaining the distinction between combatants and non-combatants in contemporary terms.' 'In the Second World War, there was a ... collision between the bombing doctrine and tactics of all nations and the basic humanitarian concept of discrimination – and the innocent civilian suffered as a result.'

In my judgement, Mr Parks is a bit disingenuous at the end when he claims that he will not, or cannot, judge whether the bombing was legal. I suspect he really believes that law lagged far behind technology, policy and circumstances, particularly the twin realities of inaccuracy and defences, which together absolved the belligerents of responsibility in the legal sense. i.e., 'not guilty'.

Professor Messerschmidt disagrees. In a tightly reasoned, sometimes syllogistic essay, he argues that 'it is reasonable to say that the most important air powers in the European theatre of war ... assumed that there was a binding code for the conduct of the air war', and that they violated this code. (However, in another place, he states, that 'when the war began, there were no specific rules governing air warfare ...'). Germany considered terror attacks and some discussion of them actually occurred, but the need for these attacks did not occur until perhaps after the Battle of Britain, by which time the

strength of the defence made the possibility of effective strategic bombing slip away. The Americans resorted to indiscriminate bombing when it appeared necessary, or as part of a synchronised effort, in 1944 and 1945, to crush their enemies. The justification then became the saving of Allied lives by ending the war as soon as possible. Law was ignored or overridden; 'all in all', Professor Messerschmidt concludes, 'there was no legal aspect to justify or excuse strategic air war against the population'.

Professor Groehler, if I understand his argument completely, would both disagree and agree with this interpretation. He acknowledges the brutality and suffering involved; he points out how different bombing was from other military activity, in that military targets were peopled by civilians who had no place to which to evacuate. In some of his most interesting analysis, he shows that the bombing fell most heavily on women, infants and the elderly. He reminds us that, sadly, civilian deaths rose from about 5 per cent of those killed during the First World War to perhaps 50 per cent of all the deaths that occurred in the Second. Why did this happen? Only part of the reason was technology, he believes: the ability to reach the civilian population, or the totality of modern war. Rather, he blames more the social and political environment, and in particular the policy of the Nazis, who unleashed terror from the beginning, and adopted terror as an instrument for conquest and the outright murder of millions as both a process for occupation and a principal goal of the conflict. Only a million and a half of the approximately 25 million civilian deaths were caused by bombing. And the 400,000 or so of the one and a half million that occurred in German territory were justified by the heinousness of the Nazi regime's actions. 'Who could . . . blame the peoples of Europe', he writes, 'fighting for their independence, their freedom, and also their physical existence, that they endeavoured to eradicate National Socialism . . .'. In other words, law aside, the context was determining. 'The fact that strategic bombings were contrary to the international law of the time is undisputed . . .'; but 'one was dealing with an opponent who had deliberately started the war, ignoring, as an element of waging total war, all rules and customs of warfare . . .'. While not justifiable, it was at least understandable – and in Professor Groehler's view, it did shorten the war.

Dr Boog disputes a central premise of Professor Groehler's paper: that the Luftwaffe engaged in indiscriminate bombing at the beginning of the war. The Luftwaffe's doctrine and training

did not subscribe to it, nor were the equipment, ordnance and systems developed and procured to effect it. Limited air resources constantly focused the operational emphasis on support of ground forces and, even in city-bombing, towards orthodox military targets. Nor did the National Socialist and Luftwaffe leadership want to risk provoking a bombing offensive on the German heartland, fearing a collapse of morale such as had happened at the end of the First World War. What has confused historians, Dr Boog believes, was the propensity of the Third Reich to threaten terror bombing, to boast of it, and early in the war – in fact, previously during the Spanish Civil War also – to label their own attacks on cities as terror, making bombing thus a tool of psychological warfare in order to intimidate and demoralise their enemy. A look at the Luftwaffe itself reveals no capability or intention to engage in indiscriminate bombing. When Dr Boog addresses the actual operations of the Luftwaffe, he finds military and economic targets the goal from 1939 to 1940, and only after the British hit Berlin did the Luftwaffe resort from time to time to raiding cities in so-called reprisal raids; but even then, almost invariably, aiming for what was militarily important. In the end the Luftwaffe slipped gradually into indiscriminate bombing, but did so as a policy only after the incendiary attacks of Lübeck and Rostock in the spring of 1942 with the so-called 'Baedeker' attacks, and later with the V-1 (and V-2) campaigns. Partly it was reprisal, partly Hitler's 'social-Darwinist' intentions; and partly it was the product of lack of alternatives, given the defences, bombing inaccuracies, the inadequacy of the bomber arm, and failures of attacks on military and industrial installations.

What are we to conclude from this? For me there is a very clear and important lesson: how you phrase the question can determine the kind of history you write. All four papers to varying degrees are structured by the question of whether Germany, Britain, and the United States violated international law in their bombing of cities in the Second World War. It is a trap we historians lay for ourselves. Behind much of these papers lays a propensity to blame or absolve, no matter how much the arguments are clothed in scholarship and the authors attempt to avoid judgement in hindsight.

I disagree with this approach; ours is not to judge but to establish fact, explain it and interpret it. At stake here is our objectivity: the core of our professionalism.

Let us go backward to the 1930s and 1940s with as much

sympathy for people as possible, to understand their thinking, their values, their reasoning, the standards of their era, and above all, the context in which they worked. To a degree, bombing was considered a panacea to avoid the horror of another First World War, perhaps utopian, but worth trying to restore to war its decisiveness and save the massive bloodletting of one's own soldiers' lives. For the Nazis, between 1939 and 1941, to use bombing militarily, or to have it appear as terrorism, might achieve war aims more quickly at less cost. For the Allies, bombing was first an act of desperation and one way to strike directly at Germany, shoring up their own morale; after that it was part of an overall, integrated effort to wear down Germany and Japan and perhaps cause surrender; and finally, it was a tool to force surrender as rapidly as possible. Remember the Allies' attitude toward the Nazis and to a degree the German nation; even before the enormity of Hitler's evil was laid bare to the world, this enemy seemed a political, moral and national threat – to the survival of values and civilisation itself – such as to justify costs on the scale of the First World War, and then some.

Remember that nearly from the beginning of flight, bombardment was seen to be able to influence war either as part of more orthodox military operations or independently – what came to be called 'strategic bombing'. Strategic bombing always aimed at the will and/or capability of an enemy, that is, at the psychology of a nation's leaders, or at the physical destruction of military/industrial targets. These two were linked, and terror was integral to the business. Now what is the relationship of terror to the law of war? It is an old, old problem. One thinks of Oliver Cromwell's effort to terrorise the Irish into submission in the seventeenth century, or the present disease of terrorism practised today by car-bomb, hostage-taking and air piracy. Where do you draw the line? How do you draw the line? I do not know.

Let us remember that war has its own internal dynamics, and that it often descends into barbarity, not necessarily by intention, but, as in the case of the Second World War, by the process of applying the entire resources of a nation's population and material resources as military power for a total war of attrition, which can only be ended by the complete destruction of the enemy society.

For the British and the Americans, there were what I would call bureaucratic realities. The leaders of an independent air

force, or one which hoped to become so, believed deeply in the concept of strategic bombing and sold it. Once the resources were allocated, the instrument had to be used, or the populations of these democracies would have reacted with utter outrage. Transport yourself backwards into the United States and Great Britain of the Second World War: the Third Reich was resisting fiercely; even in its death throes it was still capable of altering the outcome, or at least extracting a meaningful price (the Battle of the Bulge, the V-1 and V-2, and the jet planes). Men were still dying, populations sacrificing. The Russians were advancing. How would the war end? How soon? Would the fanatics in control of the German state surrender? Regardless of the wisdom of the declaration requiring unconditional surrender, that declaration was the basis of policy. Thus it is understandable that the West undertook massive blitz raids in early 1945, with all the forces available, and with diminishing numbers of targets – that is, few other ways to employ the bombers – in an effort to bludgeon Germany into surrender as quickly as possible. The wonder is that moral scruples entered as much into the calculus as they did. Out in the Pacific, the same set of factors drove the Allied campaign. In addition, the enemy was a different race and fought even more determinedly in a hopeless cause (remember Iwo Jima, Okinawa, and the *kamikazes*). The invasion of the home islands, scheduled for 1 November 1945, was expected to exact casualties from friend and foe alike in enormous numbers. Once again, that moral scruples receded into the background makes at least understandable the strategic bombing campaign of 1945, its methods, and its culmination in the use of the two atomic bombs.

In the end, I am not comfortable as the judge. That can lead to some unbelievable statements, as in the instance in April 1985 at a military college in the United States when I was asked by a colleague whether the Allied strategic bombing campaigns could be compared to the Nazi atrocities against the Jews, occupied populations, prisoners and other groups. That is the kind of nonsense only we scholars can refine to such a high degree; there is no possibility of comparing secret, mass and often premeditated murder with military operations conducted openly in a struggle for national survival.

We must retain our common sense and our objectivity. What's done is done. It happened. We cannot forget this war, nor should we, and the value of these papers is our effort to continue to study and dissect the war in full measure. We historians

are really incapable of judgements of legality and morality, trained as we are to see all viewpoints, and reconstruct the reality of a past that is always in motion, always changing. Perhaps we ought to leave the judging to philosophers, lawyers, soldiers, and statesmen – those who live in the present and need to learn from the past rather than to reconstruct it. We might even leave the judging to that peculiar amalgam of scholarship and punditry called political science, an oxymoron if ever there was one. Let us historians be satisfied with striving for a sound, impartial rendering of the past.

PART VI

Tactical and Strategic Air Warfare

21

Co-operation between Air Force and Army in the French and German Air Forces during the Second World War

Michel Forget

Introduction

The problems of co-operation between ground and air forces arose with the advent of military aviation. However, the full magnitude of these problems did not become apparent until the power of the air forces had reached a level sufficient to influence the outcome of battles. Thus from 1917 onwards, during the First World War, co-operation between the Air Force and Army started to assume its true dimensions, which were then demonstrated in a striking manner during the Second World War.

The problems of co-operation between the Air Force and Army are difficult, manifold and diverse. Their solution depends on several factors, of which three are essential:

- First, it presupposes a general operational 'doctrine' of the armed forces, coherent with both the respective strategy and the technical capabilities of the resources employed. This requires thorough knowledge, on the part of those charged with elaborating this doctrine, of the Army and Air Force, and a sufficient loftiness of vision to make the best use, without prejudice, of the complementary nature of the two services.
- Second, the solution of the problems of co-operation presupposes a specific 'organisation' of the armed forces, in order to ensure the implementation of such co-operation.
- Finally, it presupposes 'resources' - aircraft, of course, but also control systems, communications, surface-to-air resources,

adapted to the special requirements of combined air-ground operations.

It is under these three headings – doctrine, organisation and resources – that this chapter will deal with the problems of co-operation between the Air Force and Army in the French and German armed forces during the Second World War. The study is limited to the period 1939–40, in particular the French campaign at the time when the principal clash was between the French and German forces. Although most of the French forces resumed fighting from the end of 1942 onwards, their operations then took place in an inter-Allied framework, an analysis of which, as far as co-operation between the Air Force and Army is concerned, would exceed the scope of this chapter.

I: Doctrinal Problems

In France, as in Germany, the elaboration of the operational doctrine of the Air Forces – especially regarding co-operation between the Air Force and the Army – was the subject of numerous debates. However, these debates took place in climates of opinion and at times that were very different in the two countries. If the gross results of the 1939 and 1940 campaigns brutally penalised the weakness of the French doctrine, they concealed, on the German side, the inadequacies of the operational doctrine of the Luftwaffe, which would emerge later during the Battle of Britain and especially during the Russian campaign, and would lead to a revival of the debates.

The French Doctrine of Co-operation between the Air Force and Army

It is true that in France the disputes about doctrine were particularly fierce and intensified following the creation of the Air Ministry in 1928 and, in particular, when the Air Force became independent in 1933.

Causes of the French Doctrinal Disputes Two essential – and complementary – elements both dramatised the problem and checked the emergence of a coherent doctrine. Firstly, the independence of the Air Force, that is, its assumption of the identity of a third component of the armed forces, led to incom-

prehension in some members of the Army – which was all-powerful at the time – and even to indignation in others. It suffices to say that things did not go very well. Secondly, although the Army had recognised the air threat, it had not realised just how serious it was – as was amply proved by the weakness of the French air defence, among other things. Under these circumstances, the importance of air superiority and the resulting initial air battle, as well as the importance of the specific restrictions the French air forces laboured under in fighting such a battle, plus, in a more general way, certain fundamental rules for the employment of air forces – such as that of ‘concentration’ – were either hardly realised at all, or too late.

All this explains why the Army regarded the Air Force as basically a complementary service, whose operations could not but be subordinated to those of the Army units, and whose resources were to be spread out among these units. This was the basis of the concept of the ‘Co-operation Air Forces’,¹ a concept which, *per se*, was undoubtedly justified, but whose one-sided interpretation concealed a whole host of original Air Force missions, and produced a dangerous split at the very heart of the Air Force.

This attitude can be attributed to historical, political and technical reasons: historical, because the French armed forces were still marked by memories of the head-on clashes between the armies in the First World War, especially in the phase of trench warfare between 1914 and 1917, memories which overshadowed, in many cases, those of the mobile warfare conducted in 1918, when French air supremacy enabled our Air Force to play a major role in the fighting; political, in the sense that, in the inter-service struggle for influence, the Air Minister was not in the best position to defend his points of view – and his budget – before the Minister of War, who had become Minister of National Defence in June 1936 and who was, in effect, the Minister of the Army; and finally, technical: technological development of our services was slow, as the consequences of the advent of ‘motorisation’ during the 1914–18 War were not exploited as they should have been and did not bring about the necessary questioning of the concepts inherited from the early years of the First World War. It was not until 1938 that our Army and Air Forces underwent a real technological transformation. This sprang mainly from the decision taken in December 1938 to activate the first two armoured divisions in the

Army, and from the launching, in March 1938, of Plan V for equipping the Air Force, a really modern plan which would unfortunately be implemented too late.²

The Army's Point of View on Co-operation An analysis of the directives on the tactical employment of major units clearly demonstrates the above-mentioned weaknesses, especially at the level of co-operation between the Air Force and Army.

The 1921 directive, published by the Minister of War, 'states that the fire-power [of major Army units] is overwhelming and demonstrates the invulnerability, in future, of the continuous front'.³ In particular, it specifies that 'tanks must constitute a subdivision of the infantry arm, whose advance they facilitate'.⁴ The role of air forces is limited in the following manner: 'By day, the air forces will seek out stationary, marching or fighting troops and hand them over to the artillery; at night, they will destroy them with their own fire'.⁵

However, these ideas were to evolve. Following the theories of General Estienne (1921) and those of General Doumenc (1928) on the employment of tanks, Colonel de Gaulle, in his book *Vers l'Armée de Métier*, published in 1934, advocated the creation of an armoured corps which, with six divisions, was an amazing precursor of the armoured corps which overran the French positions at Sedan in 1940. . . . It is, however, obvious that the author was not aware at the time of the actual role that the air forces would have to play in such a case. There is no mention of the fire support which the Air Force could lend the armoured divisions, nor of the necessity of possessing air superiority for this purpose. For Colonel de Gaulle, the role of air forces was limited, at the level of each division, 'to constantly informing this or that general, accompanying their fellow soldiers – always the same ones – into battle, and directing artillery fire, thus providing the major unit with eyes'.⁶

This was not wrong, but very incomplete, and corresponded exactly to the ideas of that time on the role of air forces. At the end of his book, however, the author deals with combat (bomber) forces, which he basically regarded as the 'extension' of the 'Shock Corps' – i.e. the armoured corps – an extension which included the strategic sphere. However, the author continues, 'a fruitful way is open to "combined" operations, which grammarians and committees are discussing in vain today'.⁷ The idea was excellent and very promising, but direct co-operation between the Air Force and Army on the battlefield itself was, none

the less, limited to 'observation'. There was still a long way to go to the 'tank-aircraft combination'.

After 1936 there were further developments. The Directive on the Tactical Employment of Major Units dated 12 August 1936, approved by the Minister of National Defence and War, Daladier, laid down a new doctrine.⁸ It is true that, even in the introduction, a certain conservatism is apparent, even certain reservations about modern weapons, for example: 'The editorial committee of this directive was of the opinion . . . that technological progress has not brought about any significant change, where tactics are concerned, to the basic rules laid down by its predecessors.' A few lines later, in the same introduction: 'As far as the employment of tanks is concerned, it cannot be over-emphasised that the tank, today, faces anti-tank weapons in the same way as the infantry faced the machine-gun in the last war.'⁹

Although this new directive, at the level of co-operation between the Air Force and Army, took a narrow view of the problem, it contained ideas¹⁰ which should have been better exploited. According to the directive, co-operation between the Air Force and Army is essentially based on the existence of tactical air forces, with a similar structure to that of the Army and placed under its command. The missions and resources of these air forces are quite clearly centred on reconnaissance for the benefit of the Army and on the protection necessary to enable the observation and reconnaissance aircraft to do their work: 'Air forces will reconnoitre, liaise, protect and fight' (§50 of the Directive).¹¹

On the subject of reconnaissance, the directive states: 'Air reconnaissance for the artillery will take priority. . . . Air reconnaissance for the artillery thus constitutes, in the battle, the most important task of the air reconnaissance forces supporting troops' (§297).

On the subject of air supremacy, it is necessary to enable the reconnaissance forces to maintain their freedom of action: 'During certain phases of the battle, it is absolutely essential to ensure that the reconnaissance forces have freedom of action and to keep friendly troops out of sight and out of range of enemy air forces. To achieve this objective, it is necessary to possess air supremacy. This air supremacy will have to be achieved by combined action between light defensive air forces [fighters] and heavy defensive air forces [bombers],¹² the former attacking the enemy in flight, the latter on the ground. Moreover,

it will only be possible to obtain it on fronts and for limited periods of time' (§298). Thus, such co-operation leads to a waste of resources – especially as far as fighters are concerned – while the 'air battle' becomes more than usually restricted.

On the other hand, on the question of 'fire support' – 'combat' – which is essentially carried out by the bomber forces of the General Reserve placed temporarily at the disposal of the Army Command, 'it co-operates formidably in the destruction of the enemy right up to the rearmost areas of the battlefield . . . troop concentrations, march columns. . . . Maximum effect should be sought by having not only the bomber squadrons but all available squadrons participate in this fire fight. . . . Air Force Commanders should be allowed to take the initiative in launching the attacks, after they have been informed about the kind of targets and objectives they should be seeking' (§299).

It should be noted that stress is laid on the principles of concentration of resources, while some initiative is quite rightly left to the Air Force commanders in the execution of their operations. Obviously, the directive envisaged indirect support, if only because of the nature of the envisaged resources, that is, more or less long-range interdiction. Direct support is not envisaged in the French doctrine; it remains the task of the artillery. Nevertheless, the bases of the French doctrine were good for indirect support: if it did not work well during the French campaign, this was, as we shall see later, due both to the organisation and the available resources.

The Attitude of the French Air Force to Co-operation As we have seen, the autonomy of the Air Force was disputed right from its inception in 1933. It thus concentrated on doctrine, with ministers leading the way, and in particular on the 'air battle', which it considered a prerequisite for the success of any operation. This led it quite naturally to emphasise the bomber forces (which became the 'heavy defensive air forces' in 1936), which were intended to neutralise enemy air forces and their ground-support forces. It must not be forgotten that at that time there was no radar, which made it difficult for fighters to carry out their general screening mission. The battle for air superiority was thus fought, at least initially, using offensive air forces. This also meant that they possessed a strategic strike capability with which to hit the enemy's economic and industrial potential. This was a bit of Douhet's theory, even if the Air Force never really adopted it. The first two equipment programmes (Plan I of 1933

and Plan II of 1936) were to reflect this trend very accurately.

What about co-operation with the Army? It was obvious that the Air Force had to be able actively to support the operations of the Army. France was not an insular or isolated power like Great Britain or the United States, whose air forces, with a mainly strategic capacity, were essential to their show of strength. Facing Germany, France had a 'continental' defensive system directed towards the East, with her adversary threatening her with his powerful air and ground forces. Moreover, the decree of 1 April 1933, which created the Air Force, defined its missions as follows: 'The Air Force must be capable of participating in air operations, combined operations with the Army and Navy and territorial air defence.' The 'Instructions sur l'Emploi Tactique des Grandes Unités Aériennes',¹³ approved on 31 March 1937 by the Air Minister, Pierre Cot, took up and defined in more detail all these missions.

The importance of the 'air battle' is clearly explained in this directive: 'The role of the Air Force in war is to create a situation in which the air can be used for all purposes . . . and to prevent the enemy from using it for the same purposes' (§126). Of course, this battle has a defensive aspect, but also an offensive one: 'In the offensive mode, the object of the air battle is to destroy the enemy's vital forces by attacking his armed forces (air, ground and naval forces), means of communication or bases which enable his forces to manoeuvre, as well as the centres of production which provide these forces with all kinds of resources' (§129).

Co-operation with the Army receives just as much emphasis: 'Participation in the ground battle is ONE OF THE ESSENTIAL MISSIONS of the Air Force. All its capabilities can be employed here' (§169). 'The major Army units employed possess an air-control element and Air Force formations to carry out air screening and reconnaissance missions for their immediate benefit' (§171). 'All other combined air operations will usually be performed by the major Air Force units' (§172). Fire Support, according to the guidelines of the 'Directive on the Tactical Employment of Major Units' of 1936, is obviously oriented essentially towards indirect support. Direct support was only provided occasionally: 'while carrying out an attack, the action of the Air Force will extend or replace that of the artillery when the latter is temporarily not operational for technical reasons' (§175). Apart from these restrictions, the overall problem had been identified quite correctly as far as the principles were

concerned. What was undoubtedly lacking was that basic notion of the air forces switching 'back and forth' between air-superiority missions and the missions of supporting the Army, an operation which called for flexible organisation permitting the air forces to act in a concentrated manner every time.

Evaluation This all gave rise to a false dispute about doctrine. On the one hand, the airmen, by stressing the importance of the air battle, often gave the impression that they were not interested in supporting the Army.¹⁴ On the other hand, the Army was not able to understand the airmen, and devoted all its attention to the tactical air forces, whose primary tasks were reconnaissance and screening of the units, and whose organisation, closely following that of the major Army units, led to a waste of Air Force resources. In short, there was no inter-service spirit, the real basis of all effective co-operation.

Eventually, the Army's point of view prevailed. At the end of 1937, the Minister, Pierre Cot, stated: 'Pursuing the air battle for its own sake and the systematic destruction of enemy air forces irrespective of the general battle will, in the end, lead to the employment of almost the entire Air Force against uncertain targets.'¹⁵ This point of view was not wrong, but it should also have considered the other aspect of the problem: the conditions necessary for effective co-operation. What is more, from 1938 onwards, the government, realising the seriousness of the threat and French weaknesses, launched Plan V, which gave total priority to the fighter forces, because there were neither the time nor the resources to do anything else. This was a sensible decision, but it came too late. Thus, in May 1940, France had too few bombers to fight the 'air battle' and to provide the ground forces with effective support. And it was thus that the Army had its tactical air forces, with combat fighter forces that were not numerous enough and too dispersed to dictate terms, and reconnaissance forces that were numerous but, at the same time, vulnerable.

The German Doctrine of Co-operation between the Air Force and the Army

It is quite clear that in Germany the concept of the 'independent Luftwaffe', or, more precisely, the concept of the 'specific nature' of the air war – with its own rules and constraints – asserted itself without difficulty, in distinction to what had

happened in France. This is of great importance. On the other hand, there was more discussion of the role of the Luftwaffe, its co-operation with the other services (in particular with the Army)¹⁶ and its strategic role. Although the scales finally tilted in favour of co-operation, and the initial successes of the Polish and French campaigns confirmed the validity of such an option, the new scale of the fight, against Great Britain and especially against Russia, revived the debate on the place of co-operation between the Air Force and Army in the overall air strategy of the Third Reich.

The Operational (Operative) Luftwaffe The specific nature of the air war and its importance were mentioned as early as 1926, when the 'Guidelines for the Conduct of the "operative" Air War' (*Richtlinien für die Führung des operativen Luftkrieges*)¹⁷ were laid down by the Aeronautical Services in the Army Office,¹⁸ in particular by General Wilberg, a First World War pilot. It is worth dwelling on the term 'operative'. It characterises, in effect, both the Luftwaffe and one of the aspects of the war it fought. It has no meaning of its own. It does not exist in the vocabulary of the French language. When translating it, it is important to take into account the context in which it is used.

In German military terminology of that time, 'the term "operative Luftwaffe" was intended to officially underline independence of the Luftwaffe within the armed forces and its right to have its own command structure to fight the air war'.¹⁹ More precisely, 'operative Luftwaffe' characterised all Luftwaffe elements which were intended to conduct offensive air operations under the autonomous command of the Air Force. The bombers, Stukas, assault aircraft and heavy escort fighters thus constituted the 'operative Luftwaffe', as opposed to the reconnaissance and observation aircraft and the Flak units placed at the disposal of the Army, and to the planes and Flak set aside for air defence and anti-aircraft defence of German territory. It must be understood that the 'operative' air war as fought by the 'operative Luftwaffe' under these conditions covered a very broad spectrum, ranging from the strategic to close (tactical) support missions, and including missions to support operations of Army and Navy. The extent of these tasks would give rise to confusion and much debate as soon as the order of priority to be assigned to strategic missions and those that had to do with co-operation between the Air Force and Army was to be decided.

The Luftwaffe and Co-operation between the Air Force and Army The doctrine of the Luftwaffe is set forth in the document entitled 'Air Force Regulation on the Conduct of the Air War' (Luftwaffen-dienstvorschrift 'Luftkriegführung', or L.Dv. 16). This basic document was published in 1936, one year after the end of the 'camouflage' period of the German Air Force (March 1935), and was to remain in force, with a few changes, until 1945. It had been drawn up jointly by General Wilberg, whom I have already mentioned, and to a greater extent by General Wever, an Army officer who did not start to take an interest in air forces until 1933, and, despite this, formulated 'in an amazingly modern and forward-looking manner the conditions under which a future war would develop'.²⁰ This document contains three guiding ideas which were to mark the conditions of co-operation between the Air Force and the Army.

The first idea is the independence of the Luftwaffe. The introduction states: 'The regulation on the conduct of the air war deals with the principles of the air war. Conduct of the air war should be constructed to mean acts of war which are a consequence of the participation, in an *autonomous* manner, of the Luftwaffe, considered as the third component of the armed forces.'²¹ On the basis of this, it is clear that the principles of the air forces, such as that of the concentration of resources, would evidently be strictly respected within the scope of a resolutely offensive doctrine.

The second idea is the confirmation, from the outset, of the importance of air supremacy, the acquisition of which conditions everything else and requires resolutely offensive capabilities of the Luftwaffe: 'Right at the start of a conflict, the air forces will take the war to the enemy's territory. Their attacks will hit the enemy's combat capabilities and the entire population's will to resist at their very source. It is as an instrument of offensive air warfare that the air forces, in particular the bomber forces, will leave their mark on the Luftwaffe' (§2). Later on (§103): 'The enemy air forces must be attacked at the start of the conflict. Their annihilation will weaken the total strength of the enemy's armed forces, guarantee the security of our own forces, of our country and its *Lebensraum*; the offensive potential of our Luftwaffe will then be available for the execution of other important missions in the conduct of the war.' And it is thus, through this principle of 'shifting of priorities', that the battle for air superiority is presented as an element of co-operation with the ground forces (§127): 'The framework of co-operation with

the Army must not form too narrow a context. Attacks against distant targets, such as enemy air forces on their airfields, transport movements and communications, may be necessary, as well as attacks on a zone closer to the front.

The third idea: the Luftwaffe is not considered capable, *a priori*, of settling a conflict by itself through its strategic role. Nor is it considered as a simple auxiliary force, limited, for instance, to the tactical role.²² It is situated between the two extremes: Douhetism on the one hand and complete subordination to the Army on the other. But this is where the dilemma appears; what priorities are there, at the level of doctrine, between strategy and ground operations – co-operation in the widest sense of the term. Most German authors rightly emphasise the negative consequences of the term 'operative Luftwaffe' on the very concept of employment of the air arm and, consequently, on the definition of its *matériel*: 'The fact that the new Air Force suffered, in the definition of its goals and missions, from a certain lack of clarity, was the consequence of using the term "operative" which was attributed to it. The regulation on the conduct of the air war used the term "operative Luftwaffe" even in passages describing strategic missions . . . but an analysis of the regulation, and the context, show that the concept of "operative" should not be confused with the concept of "strategic" except in certain special cases, when the meaning was identical.'²³

Finally, despite this apparent uncertainty due to imprecise terminology, the priority of the co-operation with the army, with its immediate consequences for the conduct of operations, over strategic action, with its long-term consequences, emerges readily from an analysis of regulation L.Dv 16. Of course, this regulation quite justifiably rejects all *a priori* decisions in determining the priority of missions (§11): 'How the most decisive effect on the outcome of the war can be obtained and to what mission, consequently, priority must be given in each case? This must only be decided as a function of the overall situation.' However, beyond this very pragmatic reminder, a certain number of elements enable us to identify the order of these priorities, as implied by the very order in which the missions are presented and certain reservations expressed about them.

This order can be found in §10 of the regulation: immediately after the battle against enemy air forces – we have already shown the major importance that was attached to this – comes the participation in ground (and naval) operations and combat,

while the fight against the sources of the enemy forces' war potential comes last.

On the question of this fight, which was by implication strategic, Regulation L.Dv. 16 stresses numerous revealing reservations about the attitude prevailing at that time (§22):

Combat against the sources of the war potential has, *per se*, a decisive influence on the course of the war. It hits the enemy at the very root of his offensive capacity and his will to resist. However, more often than not it only has a SLOW effect on the course of events and involves the DANGER that it will have BELATED influence on the fight of the Army (and Navy). Most of the time, it will tie down powerful forces for TOO LONG. Unless the targets are such that their attack would have an IMMEDIATE impact on the course of the war, combat against the sources of the war potential . . . may ONLY be started IF the ground and naval operations are only preliminaries to the decision, IF the decisive engagements have taken place ORIF, in the war, a decision can only be brought about by destroying the sources of this potential.²⁴

Everything thus indicates that, following the acquisition of air superiority, the primary mission of the Luftwaffe is to support ground (and naval) forces, except for specific cases. Thus, this support provided to ground forces is the key point of the doctrine.

Moreover, until 1941, such a doctrine, giving priority to co-operation between the Air Force and Army, was perfectly adapted to the *Blitzkrieg* strategy pursued by Germany and explains, to a great extent, the success achieved with this strategy.

The Forms of Co-operation between the Air Force and Army Let us recall that the search for air superiority is considered an element of co-operation between the Air Force and Army. As long as this superiority had not been adequately secured, it is necessary to 'concentrate' the resources of the Air Force on this mission to the detriment of others. In this connection, Paul Deichmann²⁵ quotes General Jeschonnek, Luftwaffe Chief of Staff, who stated in June 1939, at the end of a *Kriegsspiel* (war game): 'Initially the defeat of the enemy air forces must be the primary objective of the Luftwaffe. Consequently, the forces participating in the initial attacks must be as strong as possible. The air-support mission for the benefit of the ground forces is not as important, during the early days of the war, as the mission to fight against

the enemy air forces.' Deichmann also recalls 'that it was of fundamental importance to verify, at the start of a campaign, whether air superiority was sufficient to enable the Luftwaffe to support the Army at once, or whether it was necessary, on the contrary, for the Luftwaffe to employ all its resources to destroy the enemy air forces.' This clearly illustrates the desire to 'concentrate' resources, to 'pursue a single objective' with the goal of linking very closely the acquisition of air superiority and the ability to support the ground forces.

This desire to concentrate resources can likewise be found in the use of fighters to ensure the 'screening' of forces. From 1936 onwards the Luftwaffe succeeded in retaining under its direct command all its fighter forces - with a few exceptions - and in assigning to them, for their screening missions in support of other services, zones of action adapted to their technical capabilities, i.e. adapted at least to the 'army group' level. As far as fire support and reconnaissance are concerned, the doctrine expounded in Regulation L.Dv. 16 aims to link very closely the effects of air-force action and the progress of the ground battle. It is quite significant that in the general explanation of the three missions of the Luftwaffe (§10), the employment of the Luftwaffe in support of operations and engagements on the ground is considered as 'DIRECT' support of the Army. Obviously, the adjective 'direct' must not be taken here to have the same meaning as it has in the expression 'direct support' as opposed to indirect support. It must be seen as a reflection of the desire to obtain, in all cases, the fastest possible results. This support - fire and reconnaissance - presents the two traditional aspects:

- 'Indirect' support (*mittelbare Unterstützung*) is given in the form of attacks on 'distant' targets, those which are best suited to the capabilities of bombers. It is considered as 'the most common mode of action for the Luftwaffe' (§120, L.Dv. 16). It must take its effects felt 'at the opportune moment' for the operations of the Army (§21). Of course, as Deichmann²⁶ recalls, it was obvious that the effects of this indirect support were not felt until after some time, but that by then these effects were very far-reaching, because they were not confined to a specific area, but were felt over the whole front. Indirect support is a responsibility of the 'operative' Luftwaffe, as is the support provided by the long-range air reconnaissance units.
- 'Direct' support, in Regulation L.Dv. 16, is regarded primarily

as the form of support to be provided to the Army by those Air Force units placed under its command – for the most part observation, AA (Flak) and signal units of the Luftwaffe. However, the same regulation makes provision for strong (thus 'operative') Luftwaffe forces 'to be employed in direct support (*unmittelbare Unterstützung*) during decisive ground battles' (§125). Here again, we find the principle of concentration of resources. This approach to direct fire-support includes both battlefield air interdiction and close air-support missions. Even if close air support as envisaged in the 1936 regulation was obviously not common, we know that, with the experience acquired during the Spanish Civil War and the Polish campaign, and thanks to the proven suitability of the Stukas and Henschel 123s for such operations, this form of support played an increasingly important role in Luftwaffe operations. At any rate, this was the case during the French campaign.

The Spirit of Co-operation between the Air Forces and Army: Reservations and Limits In defining the above doctrine of co-operation between the Air Force and Army the contribution by the army in Germany, a continental power, was just as important as that in France. This was reflected in a continuous pressure to get the Luftwaffe to distance itself from the theories of Douhet or from anything which could have made it more amenable to them, and, instead, to devote maximum effort to co-operation with the ground forces. The very use of the term 'operative' to characterise the Luftwaffe – and to veil the term 'strategic' – can be interpreted as a materialisation of this tendency. And many commanders of the German Army were even suspicious of this term 'operative'. Thus, Horst Boog, in his book *Die Luftwaffenführung 1935–1945*, reminds us of the remark made by General Beck, Chief of the Army General Staff, at the end of a *Kriegsspiel* in 1938: 'Make sure that the Luftwaffe does not fight an "operative" war somewhere in the depth of enemy territory while our infantry remains frozen in a war of position.'²⁷

Nevertheless, doctrinal disputes were much less fierce in Germany than in France, while the Luftwaffe succeeded without much difficulty in gaining acceptance for the basic operational principles of air forces, based on the concentration of resources and the transfer of these resources from one mission to another, all of which required specific operations, conducted by a truly 'autonomous' Luftwaffe. There are three reasons for this:

Firstly, it must be remembered that Goering, who determined the fate of the Luftwaffe in his capacity as Air Minister and Commander-in-Chief of the Luftwaffe, was the second most important person in the state, after the Führer. This was undoubtedly of great significance, and it enabled the Luftwaffe to defend its points of view, at least during these crucial years of preparation for war.

Secondly, the breaking up of the Germany Army in 1918 led it to question itself when it started to be rebuilt. It was thus easier to consider new ideas on the employment of forces – a consequence of the confusion in the final months of the First World War. In addition, in the same context, Hitler's accession to power gave a new impetus to all those who were just waiting to break the chains of the *'Diktat'* of Versailles, and facilitated the emergence of a dynamic and offensive strategy in which air forces – like motorised and armoured forces – were to play a leading role.

Finally, many of the commanders of the new Luftwaffe were former Army officers who had already served in senior positions in that service (Kesselring, Stumpff and Jeschonnek).

Such a situation could not but facilitate mutual understanding and co-operation between the services. Horst Boog, writing on this subject, says:

Finally, to many former Luftwaffe officers, who had been trained in the Army, the Regulation on the Employment of Ground Forces (Heeresdienstvorschrift 300 or HDv 300) was much more familiar than the corresponding Luftwaffe regulation (L.Dv. 16). The 'Army' regulation laid down the achievement of air superiority at the most decisive points of ground operations . . . and ordered close cooperation between the Luftwaffe and the Army, thus prefiguring the essential points of L.Dv. 16.²⁸

Beyond all questions of organisation, which we shall analyse later, such a spirit of co-operation could be found 'in the field'. In this context, Horst Boog recalls the very significant statement made by Field Marshal Kesselring when he was commander of the 2nd Air Flëet (Luftflotte) 'adapted' (attached for co-operation) to the Central Army Group in Russia:

As a former Army Officer, I understood the needs, concerns and wishes of the ground forces too well not to support them fully. . . . I was not under the command of von Bock, commander of this Army

Group, but I regarded myself as being voluntarily under his command in all questions concerning the tactical employment of the ground forces. . . . I told my airmen and their generals that they were to consider the wishes expressed by the Army as orders issued by myself. . . .²⁹

Thus, the doctrine of the Luftwaffe, especially on co-operation between the Air Force and Army, was remarkably well adapted to the strategy of 'lightning campaigns' – facing opponents who, owing to their geostrategic position, could not withstand the initial shock of the Panzer divisions supported by the Luftwaffe. This doctrine was confirmed time and again, thanks to a formidable 'spirit' of co-operation. However, everything changed when the conflict took on continental, and then world-wide, proportions, and when the balance of forces tilted in favour of the adversaries of the Reich. In the West, the Luftwaffe's failure against England exposed the weakness of its strategic capabilities. This was the consequence of a doctrine centred essentially on the problems of air superiority and direct co-operation between the Air Force and Army. Worse still, having lost air superiority, the German High Command refused for a long time to draw the right conclusions. Instead, it turned its back on the principles it had itself decreed, and continued to pursue an offensive policy. It was also slow to give the required priority to air defence³⁰ in the West after 1941.

In the East, co-operation between the Air Forces and Army, in the form of direct support,³¹ gradually absorbed almost the entire potential of the Luftwaffe – a potential which was already weak in view of the great size of the theatre of operation. There were several reasons for this: an obvious underestimation, from the very outset, of the enemy's capabilities; the strategic weakness of the Luftwaffe; and the increasing influence of the Army in the conduct of the war in the East; but also departure from the doctrine itself, facilitated by memories of successes achieved during the initial campaigns of 1939 and 1940 and by the above-mentioned tendency, hinted at in Regulation L.Dv. 16. Thus, the 'operative Luftwaffe' was not only to turn its back on any strategic role (which it could have played in 1941 and 1942), but was also to become a 'tactical Luftwaffe' – in the German sense of the term at that time, i.e. organised for direct support of ground forces. Under these circumstances, the bomber formations played an increasingly important role on the battlefield, on missions for which their equipment was not designed. They

thus sustained the well-known enormous losses, Russia having become the 'Verdun of the Luftwaffe'.

Conclusion

Both the French and German doctrines of co-operation between the Air Force and Army contained weaknesses.

On the French side, this doctrine suffered from a lack of clarity in the determination of priorities between the various missions, the complementary nature of which was likewise not sufficiently emphasised. The Army undoubtedly took too narrow a view both of the air threat and the role of our own air forces.

On the German side, on the other hand, this co-operation, based on a doctrine difficult to contest, nevertheless ended up losing, under the pressure of events in the East, the dimension that it had at the beginning, with the Luftwaffe seeing its role more and more reduced to that of a super-artillery. But could the German High Command have acted differently after 1943 in the extremely critical situation in which its forces found themselves? All this proves, at any rate, that, beyond words and analyses, doctrines are only as good as the way in which they are applied. This is why, in order to treat the problem in more detail, we must tackle the problem of the organisation of the air forces, both French and German, with regard to co-operation between the Air Force and the Army.

II: Organisation

General Organisation of the French and German Air Forces (cf. Annexe 1a, b)

As Annexe 1 shows, the essential difference between the French and German organisations lies in the conditions of adaptation to the change-over from peacetime to wartime and in the structures of the operational commands.

The *Luftwaffe* was repeatedly reorganised between 1933 and 1939. However, two principles were always respected: that of the same organisation in peacetime and wartime; and that of the coupling of operational and territorial structures, with the latter being subordinated to the former. Thus in 1939 the *Luftwaffe* was divided into four 'Air Fleets' (*Luftflotten*), two facing the

East and two facing the West (cf. Annexe 2). Each air fleet constituted, *de facto*, a veritable small air force with all the operational and logistic resources to conduct all air operations in one part of a given theatre of operations, corresponding moreover to the zone of action of an 'Army Group'. The Air Fleet Commanders were directly subordinate to Goering, 'Air Minister AND Commander-in-Chief of the Luftwaffe'. Each Air Fleet Commander bore the title 'Commander of Air Fleet 1, 2, 3 or 4 AND Commander East, North, West or South-East'.³² Subordinate to each Air Fleet, territorial command was exercised by the *Luftgau* Commanders. The *Luftgau* was a territorial subdivision, comparable to a small Air Region (*Région aérienne*) in the French system. The *Luftgau* commander was responsible for the ground support organisation, supplies and administration in his command. He also had air-defence responsibilities and, for this purpose, had fighter and Flak units at his disposal. The *Luftgau* commanders were also, of course, responsible for the air bases (*Fliegerhorst*).

At the operational level, each Air Fleet Commander had at his disposal forces organised into major aircraft, Flak and signal units. The major aircraft units were the 'Air Corps' (*Fliegerkorps*) and 'Air Divisions' (*Fliegerdivision*), each corps and division being composed of a certain number of wings (*Geschwader*) which, in turn, were divided into groups (*Gruppe*) and squadrons (*Staffel*). However, not all air units were organised in divisions or grouped in corps. Some of them were indeed independent.

The Organisation of the French Air Force was distinctly different to that of its adversary of that time.

The peacetime organisation was different to that in wartime (Annexe 1b). In peacetime, metropolitan France was divided into four *Régions aériennes* – Metz, Paris, Tours and Lyons. The commander of such an 'Air Region' commanded both the troops and the ground services. It was organised on similar lines to the ground forces, and did not meet wartime requirements. In particular, at the operational level there were no major Air Force units which could be separated from ground units and were capable of being employed immediately in wartime. A reorganisation decided upon in September 1936 to remedy this situation (Decree of 3 September 1936 on the Creation of 'Air Corps') was rescinded two years later (Decree of 2 September 1938).

It was only in wartime³³ that a distinction was to be made

between territorial and operational command. The air region commanders would then only retain their territorial responsibilities. They would become responsible for providing logistic and administrative support to the major Air Force units in accordance with the orders and directives of the Commander-in-Chief of the Air Force.

The air forces were restructured, but in a manner totally different to that of the Luftwaffe in Germany. The French Air Force was split into two elements: on the one hand, there were the units of the 'General Reserve', organised in *Groupements* and *Divisions Aériennes* (from early 1940); on the other hand, there were the units assigned to the 'Commandant des Forces aériennes de Coopération' (Commander of the Tactical Air Forces), who was subordinate to the Commander-in-Chief North-eastern Theatre of Operations (February 1940). The units of the 'General Reserve', for their part, were commanded by the Commander-in-Chief of the Air Force. From early 1940 onwards, the basic unit in the Air Force was the *Groupe* - fighter, bomber or reconnaissance. The number of planes per group varied greatly in the bomber forces (between 10 and 15). In May 1940, it averaged between 25 and 30 in the fighter forces and was around 10 in the reconnaissance and observation group. These figures are thus appreciably lower than those for the equivalent Luftwaffe units. A fighter *groupement* comprised 2 to 5 fighter *groupes*, and a bomber *groupement* comprised two bomber *groupes*. The *Division Aérienne* (Air Division) comprised two or three *groupements*, i.e. 4 to 6 groups.

In conclusion: While, at the operational level, French organisation was undoubtedly not as coherent as that of the Luftwaffe and made the rapid concentration of resources in a given zone or direction more difficult, at the theoretical level it was better suited than its rival to the organisation of offensive strategic operations - even if the French Air Force did not have the time, opportunity or resources to conduct such operations.

However, at the organisational level, the Luftwaffe, with its bombers spread among the Air Fleets, proved that it was mainly suitable for the conduct of air-ground operations at the 'Army Group-Air Fleet' level. It was less suitable for offensive strategic operations such as those conducted against England from the summer of 1940 onwards and those it should have conducted against Russia at least until the end of 1942.

Organisation of Co-operation between the Air Force and Army
(cf. Annexe 4a, b)

In Annexe 4 the organisation of co-operation between the Air Force and Army in the Luftwaffe and French Air Force is illustrated in a diagram. The comparative table illustrates important analogies and differences at a glance.

Analogies: In both the French and German air forces these basically have to do with the structure of co-operation copied from the organisation of the ground forces and subordinate to them. This was reflected in both air forces by a series of posts for 'Air Force Commanders', 'Air Support Commanders' or 'Air Liaison Officers', subordinate, for *employment*, to the Army at every level. (In Annexe 4, the big right-hand rectangles thus stand for the area of responsibility of the Army High Command.)

On the German side, every level of the Army structure – from the Army High Command (Oberkommando des Heeres – OKH) down to the division (at least those divisions at the point of main effort – *Schwerpunkt*), has a corresponding Air Force officer who is in the Air Force chain of command but is placed, for *employment*, under the command of the corresponding Army officer: General of the Air Force with the Commander-in-Chief of the Army, Air Force Commander (KOLUFT) to each Army Group and Army, Air Force Liaison Officer to the corps and divisions.

On the French side, the structure is similar, at least down to the Army Group level: Commander of a Zone of Air Operations under the Army Group Commander, Air Force Commander under each Army and Corps Commander, Air Liaison Officer in the principal divisions. Similarly and covering the entire chain, the 'Commander of the Air and Air Defence Forces placed at the Disposal of the Commander-in-Chief of the Ground Forces, North-eastern Front' (Commander of the Tactical Air Force)³⁴ is subordinate to the Commander of the North-eastern Theatre of Operations – a level which, in 1940, had no equivalent in the German organisation.

Second analogy: The existence, in both air forces, of an organic 'Army' air arm, integrated into the structure described above. This air arm comprised air units assigned to the various levels of command of the Army – cf. Annexe 4. In the Luftwaffe, this organic air arm consisted solely of reconnaissance observation, DCA and signal units. It was disbanded in 1942 to save resources, and the corresponding 'Koluft' was also abolished and replaced by Air Force Liaison Officers.

Differences: While French co-operation between the Air Force and Army exhibited a 'binary' character – independent action OR almost total subordination of the air forces to the Army command – the organisation of the Luftwaffe was much better balanced for the principle of 'concentration' of resources.

The organisation was better balanced on the German side for two reasons:

Firstly, although there was no truly 'combined' Air Force-Army agency, there existed in the German organisation 'bridges' between the Army and Air Force commands which enabled the officers in charge to consult each other and, consequently, to decide on action which took account of the limitations of the two services, Army and Air Force. These 'bridges' were: firstly the Supreme Command of the Armed Forces (Wehrmacht). Of course, as H. Boog points out in his book *Die deutsche Luftwaffenführung*,³⁵ the three Commanders-in-Chief of the three services – Army, Air Force and Navy – were very jealous of their prerogatives and did not allow themselves to be controlled by the OKW. In addition, there were questions of personalities. Goering, for instance, would not take orders from anyone except the Führer himself! Nevertheless, the OKW was a truly joint-service body, which took the major decisions on the general conduct of operations. Moreover, there were other bridges at lower levels: between the Army Groups and Air Fleets there was certainly 'adaptation' – in the present-day meaning of the term; likewise, there was close co-operation on the 'Army' and 'Air Corps' level, at least in the case of those Armies at the focal point of action. This 'adaptation' was made possible by the communications linking the appropriate Army and Air Force levels of command and by the liaison on the ground and in the air – without there being specific 'adaptation' agencies.

Secondly, in the Luftwaffe, the organic air units placed at the disposal of the Army command comprised solely reconnaissance units, as we have seen.³⁶ Once again they were squadrons (*Staffel*), which we will translate here as 'escadrons' by analogy with present-day French structures. After 1936-7, not one single fighter group was assigned to the major Army units, despite the repeated demands of the German Army before the war.

Finally, Annexe 4a clearly shows that, in the Luftwaffe, the 'bulk' of their air forces remained *directly* under the various command levels of the Luftwaffe itself – in particular all bomber forces, including the Stukas, as well as the fighter units. This enabled the Luftwaffe both to 'concentrate' its resources as

dictated by the situation and to 'shift' its effort rapidly from one sector to another or from one mission to another, depending on the situation. It will be noted in Annexe 4a that, as far as support is concerned – air cover or close air support – the Luftwaffe was able to provide this support to the various Army levels without having to integrate its air units into the Army structure.³⁷

The fighter units, which were mostly placed under the command of a 'Commander of Fighters' (Jafü) at Air Fleet level, were not restricted to too small an area such as that of an Army. On the contrary, they operated at least throughout the 'Army Group' area, as this was best suited to their capabilities.

For fire support, such an organisation enabled employment of the bomber forces in indirect support in the depth of the enemy battle disposition, once air superiority had been acquired. This type of indirect support was proved at the Army Group–Air Fleet level. Direct support – battlefield interdiction and close air support – was organised at the Army–Air Corps level for every ground Army operating at the *Schwerpunkt* of action. Close air support was provided for the benefit of the Corps and even the Divisions employed where the main battle was. The twin-engined bombers were reserved, in principle, for indirect air support – at least until 1941 – and 'interdiction'. The so-called 'assault' aircraft – *Schlachtflugzeuge*, including the Stukas – were reserved for close air support. These planes were regrouped very early – from the time of the Polish campaign – into a division, and subsequently a special 'Air Corps', VIII Fliegerkorps.

However, an organisation of this kind ran the risk of duplication of effort in the area of support, especially where reconnaissance forces were concerned: indeed, until 1942 there were, in fact, two reconnaissance forces, one properly belonging to the Luftwaffe for tasking, the other to the Army for employment at the Army Group and Army levels. It is not surprising that such a system was modified in an effort to consolidate resources – as we have already seen – from 1942 onwards, when the relative weakness of the Luftwaffe in relation to the size of the theatre of operations proved to be intolerable.

On the French side, the organisation of the Air Force was less flexible and exhibited the 'binary' character already mentioned. Annexe 4b illustrates the characteristics of the French system of co-operation between the Air Force and Army:

Firstly, there was no real Air Force–Army Combined Command Post, where each representative of one service is on an equal footing with the representative of the other service. The

level of 'Commander-in Chief of the French Armed Forces', at the same time 'Chief of the National Defence Staff', was not really a co-ordinating body for the conduct of operations. It was there to distribute the resources among the various theatres – which was not of much use in 1939–40, given the shortness of the campaign and the nature of the operations, most of which took place on the north-eastern front. The Commander-in-Chief of the Air Force had a choice between using his 'General Reserve' for offensive actions of a strategic nature OR making all or some of his reserved resources available for co-operation, i.e. integrating them into the Army structure. The result was a hierarchical system based on that of the ground forces and parcelled off between their various echelons.³⁸

Secondly, the tactical co-operation air forces were much more numerous in the French Air Force than in the Luftwaffe, especially as regards fighters. For instance, at the level of each army not just a reconnaissance *groupe* was assigned, but also a fighter *groupe*, which was restricted to a confined section of terrain. This amounted to turning one's back, in this sphere, on the principle of concentration. Annexe 5 shows in detail the order of battle of the Luftwaffe and French Air Force on 10 May 1940: on the French side, it will be seen that *eight* fighter *groupes*, or 40 per cent of the twenty deployed at the North-eastern Front of Operations, were spread between the North Sea and the Swiss border to support the eight French armies deployed along the border.

Finally, the Commander of the French Air Force could only exert very little influence on the actual air operations, while the system of 'co-operation' did not permit sufficient concentration of resources, considering the complexity of the Army structure in which these resources were integrated and the multiplicity of echelons existing between the air-unit level and the major levels of command (Front and Army Group), which were the only ones to establish priorities in action. The shortcomings of this system, marked by the predominance of the 'Army' concept, aggravated the number and kind of the consequences of the technical weaknesses of the French Air Forces.

Organisation of Close Air Support (cf. Annexe 4a, b)

French side: The organisation – and resources – established for co-operation between the Air Force and Army in the French system reflect the contrasts of doctrine between the two

services. The Army obtained the resources it desired, namely those which enabled it to 'carry out reconnaissance' for its units and to 'screen' its movements from enemy air forces. This explains the importance of reconnaissance and observation forces in the Army, the Corps and the Divisions: 8 reconnaissance *groupes* at the North-eastern Front on 10 May – out of a total of 11 on this date³⁹ – plus 32 air-observation *groupes* (GAO) equipped with Potez 63/11s and Mureaux 115/117s. In all, there were over 700 aircraft in line, of which almost 500 were modern aircraft. This explains the previously mentioned assignment of *one* fighter *groupe* per Army.

This concept led to close air support on the battlefield being limited to reconnaissance support in the form of artillery direction, troop guiding and, of course, rear area reconnaissance. The fighter forces ensured the 'cover' of the battlefield. Under these circumstances, the air forces had to concentrate most of their fire-support effort on indirect support. Moreover, the 'Règlement de Manœuvre de l'aviation' (1937) states that it is 'the heavy defensive air forces' – bombers – who were charged with attacking battlefield targets and vital enemy communications and agencies 'to the limit of their range'.⁴⁰ Considering the nature of the bombers at its disposal – all twin-engined planes – the Air Force could only concentrate on attacking targets in depth: lines of communication, troop concentrations. . . . This is precisely what happened. As far as we know, hardly any missions were carried out in close air support, and no special organisation was established for this purpose.

On the German side it was totally different, and in addition contrary to the provisions of the Luftwaffe Field Manual L.Dv. 16 of 1936. In paragraph 132, this regulation only provided for intervention by assault forces 'at close range' if the artillery proved too weak and for as long as it remained so. We know that the experience of the Spanish Civil War, with the employment of the Hs 123s, the first dive-bombers, which were very modest in size and performance, led to the development of the initial concept. Close air support, which was not trusted very much to start with, proved to be particularly effective. The Polish campaign provided striking confirmation of this point of view. The French campaign, followed by that in the Balkans and subsequently the initial operations in Russia, led the Luftwaffe to establish a system of close air support which foreshadowed the most modern systems.

It was also the Luftwaffe which developed the procedures and

means of control suitable for close air support. These procedures and the corresponding organisation are illustrated in Annexe 6. In particular, the first 'Forward Air Control Teams' were established during these campaigns, although these teams were always operated by signal officers, even if after 1941 they received a special training to ensure visual control of aircraft.

However, three remarks must be made here:

Firstly, only one Air Corps – von Richthofen's 'VIII Fliegerkorps' – was specialised in this kind of mission – at least until the Russian campaign. During the French campaign this Corps provided the Air Fleets 2 and 3 with support and combined all the Stukas (eight groups) plus one group of Hs 123s.

Secondly, contrary to what many have believed, it was not *all* the divisions – especially armoured divisions – which benefited from massive close air support, but merely those at the point of main effort – the *Schwerpunkt*. The principle of concentration of resources was always observed, and largely explains the huge number of successes in close air support.

Finally, these successes also had a drawback. They caused the German command to exaggerate the role of close air support in the spectrum of possible Luftwaffe action – especially from the Russian campaign onwards. The Luftwaffe thus gradually allowed itself to be completely absorbed into the role of a super-artillery, whose effectiveness became more and more doubtful as the force ratio was reversed, and which incurred considerable losses.

III: Means of Co-operation Between the Air Force and Army

The quality of the means employed had a decisive influence on the effectiveness of co-operation between the Air Force and Army, over and above all questions of doctrine. This is not to be an exhaustive analysis of the means utilised, but rather a brief survey of three areas whose development played a major role in co-operation – assault-aircraft policy, anti-aircraft defence and signal communications.

Assault-Aircraft Policy

The Stukas and, in a more general way, the dive-bombers were considered to be determining factors in the successes achieved

by the Luftwaffe during the initial campaigns. Many people regretted that the French Air Force did not have equivalent planes at its disposal. It was, however, not indifferent to the problem of assault aircraft. We know it adopted a very different formula,⁴¹ that of the twin-engined aircraft capable of approach and attack at a very low altitude. An example is the Bréguet 691, later 693. This was a twin-engined, two-seater plane capable of carrying eight 50-kilogram bombs and equipped with a 20 mm co-axial cannon and four machine-guns, two of which were in the rear turret. There were two assault *groupes*, equipped with Bréguet 693s, on 10 May 1940. Towards the end of the same month there were four. There is no question of judging here the merits to the Br 693 on the basis of the results achieved during the French campaign and the losses sustained. Indeed, it was not until the end of April that the first operational units were activated, following a short phase of tactical experimentation on Br 691s. Under these circumstances it was difficult to hope for decisive results. Nevertheless, the Br 693 was not a bad choice. The aircraft foreshadowed in any case the assault aircraft – and light bombers – of the final years of the war, when approach and attack were taking place at increasingly lower altitudes as ground air defence became increasingly dangerous . . .

On the other hand, while the successes of the Stuka were undeniable during the early years of the war, and there were decisive achievements on the battlefield in Poland and during the French campaign, it must be realised that these successes were largely due to the air superiority which the Germans had been able to acquire right from the outset and, above all, to the dramatic weakness of the air defences which opposed them. As soon as those defences became stronger and air superiority was lost, as happened in both the East and the West after 1943, use of the Stuka had virtually to be abandoned: with the exception of a few anti-tank units (30 mm anti-tank guns) still employed in the East in 1944–5, most Stukas finished up as night bombers (in the West) or glider tugs! The formula was successful but not very promising.

Anti-Aircraft Defence (DCA) and Flak

The equipment, organisation and, above all, conditions of employment of air-defence artillery in the services inevitably imply co-operation between ground and air forces, which is not easy to perfect. Moreover, in 1940, neither Germany nor France had

found adequate solutions to this problem, even if the 'Flak' proved to be much stronger and more effective than the French anti-aircraft defence (DCA).

In Germany, the Flak was totally dependent on the Luftwaffe – for development, training, establishment and employment. At home, for the defence of the Reich, the organisation in 1940 was relatively simple and coherent: its basis was the *Luftgau* (cf. Annexes 1a and 2), whose commander was responsible to the relevant Air Fleet commander for the air defence of his territory – fighters and Flak.⁴² In the Army, the problem was initially more complex: the Flak units earmarked for the Armies – all motorised – were consolidated for the most part into *Flakkorps*⁴³ – a sort of anti-aircraft corps – with one *Flakkorps* per Air Fleet (cf. Annexe 5a for the situation in May 1940).

This made it possible to co-ordinate Flak action with that of the major Army units, thanks to the co-operation between the Army Group and Air Fleet levels. Thus, in May 1940, the I *Flakkorps* of the Air Fleet 3 was employed primarily to protect the action of von Kleist's 'armoured wedge' – von Kleist's Panzer Group, 5 Panzer divisions – which was to penetrate the Ardennes and then advance to the Channel coast. This explains the density of the flak which met French and British bombers attacking the Meuse bridges at Sedan.

However, the disadvantage of this system lay in the command relationships between, on the one hand, the commanders of the ground units in which the Flak units – at the battalion and battery level – were operating and, on the other hand, the commanders of these Flak units who were responsible, for employment, to the Air Fleet via the *Flakkorps* commander, or to the Koluft as soon as they were assigned to an Army, Corps or even a Division.

The problem was made more acute by the 88 mm gun, which proved to be a formidable anti-tank gun. Many commanders of ground units tended to use it for this purpose rather than for anti-aircraft defence. Most Flak units were actually 'integrated' in ground units: everything rested on the individual 'spirit of co-operation' of the commanders present. Such a spirit did exist, but there was a certain amount of 'friction' here and there:

The mission order received by the commander of a Flak unit as soon as he had been assigned to a front-line Army unit instructed him to 'cooperate' with this or that division. This formulation was different to that most commonly used in the Army, where it could only be a

question of working 'under the command' of this or that division. This difference was always underlined – and sometimes dramatized – in the war accounts written by Army officers.⁴⁴

Let us not forget that the Army units – divisions and especially armoured divisions – gradually strove to have *organic* Flak units. By 1940, it had only been possible to 'convert' a few machine-gun battalions to 20 mm anti-aircraft guns.

In France, the system was the opposite. The anti-aircraft (DCA) units belonged to the Army. For employment, they were responsible to the Air Force, both at home, where air defence was the responsibility of the 'Inspector General of Fighter and Air Defence Forces', and in the services, where the 'Commander of the Tactical Air Forces' was also 'Commander of the Anti-Aircraft Ground Forces placed at the Disposal of the Commander-in-Chief of the French Ground Forces on the North-eastern Front'. In the ground forces, the French DCA units were thus in a normal hierarchical system. However, this system had two drawbacks:

Firstly, it made it difficult to concentrate resources to cope with the reality of the situation, since everything was based on the hierarchical structure of the omnipotent Army, where everyone naturally wanted to hold on to his own resources.

Secondly, and more importantly, since the DCA was responsible to the Army for its development and the determination of its resources, everything depended on the Army's perception of the air threat – and, in a more general way, its perception of the course of the 'air battle', with the result of the employment of the DCA and fighters conditioning its 'security'. This brings us back to the problem of doctrine. Between the two wars, this perception obviously left much to be desired. The DCA was dreadfully neglected:

Although in the 1914–18 war, the DCA had proved its effectiveness, it was sacrificed after 1920. Entrusted to the Army . . . it had seen its importance denied and its funds cut. Contrary to what happened in the case of aircraft, we had a remarkable prototype dating from 1922, the 90 mm gun, with a performance comparable to that of the German 88 mm gun. Our light DCA had the 25 mm and 37 mm guns which were also excellent. The reason for this neglect was that the Army was counting on fighters, while at the same time helping to curb their development by cutting the budget.⁴⁵

In 1940, the scales were tilted heavily in favour of the Luftwaffe. In 1940, France had a total (territorial air defence and anti-aircraft defence in the Armies) of around 4,000 guns (one half of 75 mm calibre, the other half of smaller calibres – 13.2, 20, 25 and 37 mm), of which around 2,000 guns (1,000 heavy guns) were distributed among all the Armies from the North Sea to the Mediterranean.

Germany, for her part, had around 15,000 guns, including over 3,000 88 mm guns and over 10,000 light guns (mainly 20 mm and 37 mm guns).

Signal Communications

The employment of air forces and, in particular, co-operation between the Army and Air Force presupposes special signal communications. This was a considerable trump for the Luftwaffe, whose efforts in this respect were remarkable.

In France, the importance of communications did not escape the attention of those in charge. However, France virtually had to start from scratch in this field. Before 1933, in fact, the problem had not been tackled. This delay, along with budgetary problems, explains the serious shortage of signal communications equipment in the French forces – especially the Air Force, no matter whether it was aircraft radio equipment, aircraft navigation infrastructure or special communication networks. As a result, co-operation between the Air Force and Army suffered seriously, both in the transmission of orders and in the forwarding and evaluation of intelligence.

In the Luftwaffe, the importance attached to signal communications is immediately apparent in the organisational diagram of this service (cf. Annexe 1a). The same man – General Martini – held the post of Chief Signal Officer from the beginning right through to 1945, and from October 1939 onwards he reported directly to the Chief of the Luftwaffe General Staff. Efforts made in this field were reflected not only in the modern radios with which all the air units were equipped – there was a similar effort in the Army, mainly for the armoured units – but also in the establishment of communication networks specifically for use in the air. At the same time, motorised units capable of being airlifted and airdropped were created.

In the field of support, to improve target acquisition, experiments were carried out during the Polish campaign with the first 'pathfinder' units, equipped at that time with Ju 52s and He

111s fitted with special radio and navigation equipment. In addition, the commanders and liaison officers responsible for support had their own communication equipment – radio and wire. The special air control equipment (cf. Annexe 6) belonged to a special signal company (*Luftnachrichtenkompanie z. b. V.*) employed at the Air Corps level (in principle, VIII Fliegerkorps). This company was responsible for providing support to the liaison and air control teams (*Luftnachrichtenverbindungstrupps* and *Schlachtfliegerleittrupps*) as soon as the latter were activated.

The control and air-communication resources were thus distributed not only in the operational structure but also in the territorial structure; if the *Luftflotte* had its own signal command, each *Luftgau* also had its own, charged primarily with equipping the air bases (*Fliegerhorst*) with radios, goniometers, teletype machines and telephone sets, as well as equipment for the transmission of meteorological data.

Such an organisation facilitated co-operation between the Air Force and Army to a great extent. To illustrate the above remarks, let us recall that in June 1939, out of a total strength of 330,000 men, the *Luftwaffe* had 100,000 men in the Flak and 58,000 in signal communications, a proportion which was maintained as the manpower total increased in the course of the war.

Conclusion

There are many lessons to be learned from co-operation between the Air Force and Army in the French and German forces at the time of the French campaign.

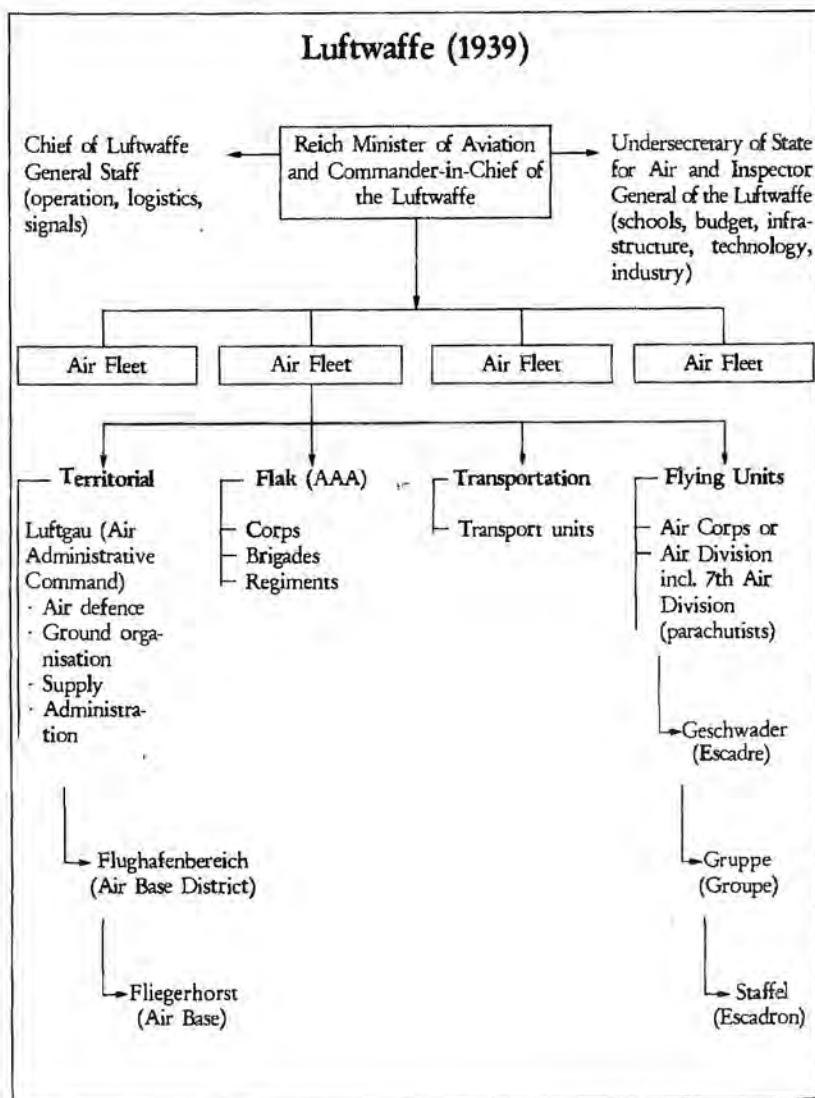
Although doctrinal disputes were more serious in France, their negative consequences were felt in both camps, immediately in France and in the long term in Germany. They demonstrate that it is absolutely essential to rise above the disputes in order to deal with these problems of doctrine, that it is essential to have a thorough knowledge of the capabilities and limitations of both services – Army and Air Force – in order to find the most effective solutions, without any preconceived ideas. This also means demonstrating the whole importance of combined commands.

With respect to the organisations and resources employed to provide this co-operation, the *Luftwaffe* obviously paved the way to modern solutions, but did no more than outline the necessary structures and the resources to be devoted to this end.

If this organisation was well suited to the conduct of air-ground operations, it was not as well suited to the conduct of strategic operations – such as those that it mounted against England and those that it should have mounted against Russia in 1941 and 1942. For war is a whole, and an army cannot accomplish its mission if it cannot cope with all aspects of operations. For the French Air Force, the opposite was the case: its organisation enabled it for strategic air operations, operations which it had neither the time nor the resources to conduct, whereas the structure of co-operation with the ground forces did not enable it to make optimum use of the inherent capabilities of its air forces.

Finally, in both camps, three elements were lacking – at various levels: a more positive spirit of co-operation; better defined structures of co-operation, with permanent bodies capable of determining and conducting 'joint' operations; and finally, sufficiently strong air forces to cover, whether simultaneously or not, both the 'tactical' and 'strategic' fields. It was to be the Anglo-Saxons – especially the USA – who, in the course of the Second World War, were able to show these elements to the best advantage and to make the most of the capabilities of their air forces. They were also to be the victors . . .

Annexe 1a Operational and territorial organisation



Annexe 1b Operational and territorial organisation

Armée de l'Air

PEACE (1938)

Minister of Aviation

Chief of Staff of the Air Force

5 Inspectorates
incl. air defence

4 Air Regions (Metz, Paris, Tours, Lyon + North Africa (Algiers))

Air Region

Air Region

Air Region

Air Region

Territorial

Air District

Air Base

· Administration

· Technology

· Logistics

Operational

· Fighter units

· Bomber units

· Training units

[Escadres-Groupes]

WAR

Minister of Aviation

Commander-in-Chief, French Armed Forces

Commander-in-Chief of the Air Force

Territorial

4 Air Regions

· Air Districts

· Air Bases

Operational

General Reserve

· Divisions

· Groupements

· Groupes

Operational

Army

Cooperation Air Force

— AOC, Theatre of Air

Operations

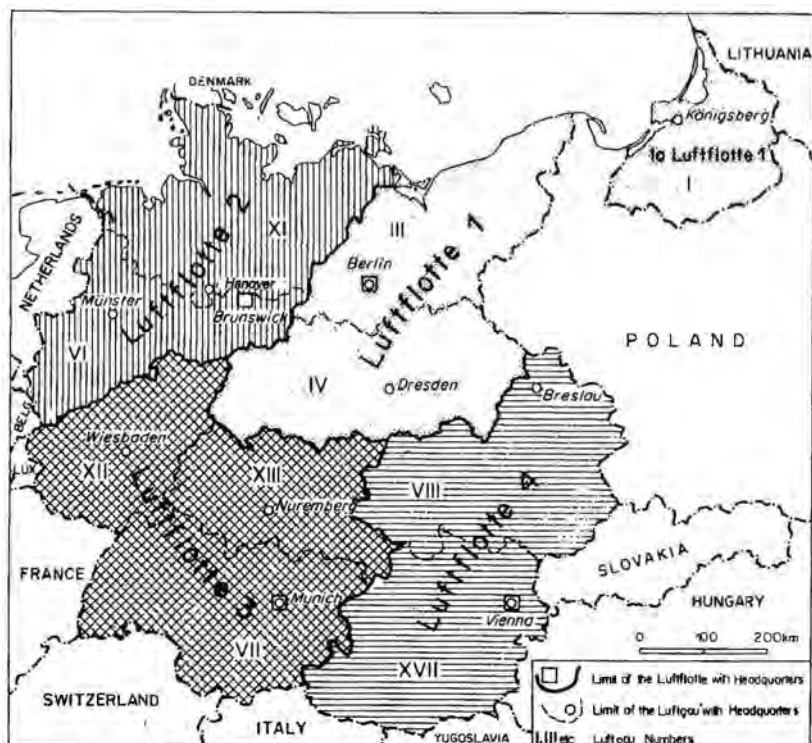
— AOC, Zone of Air

Operations (Army

Group)

— AOC (Army)

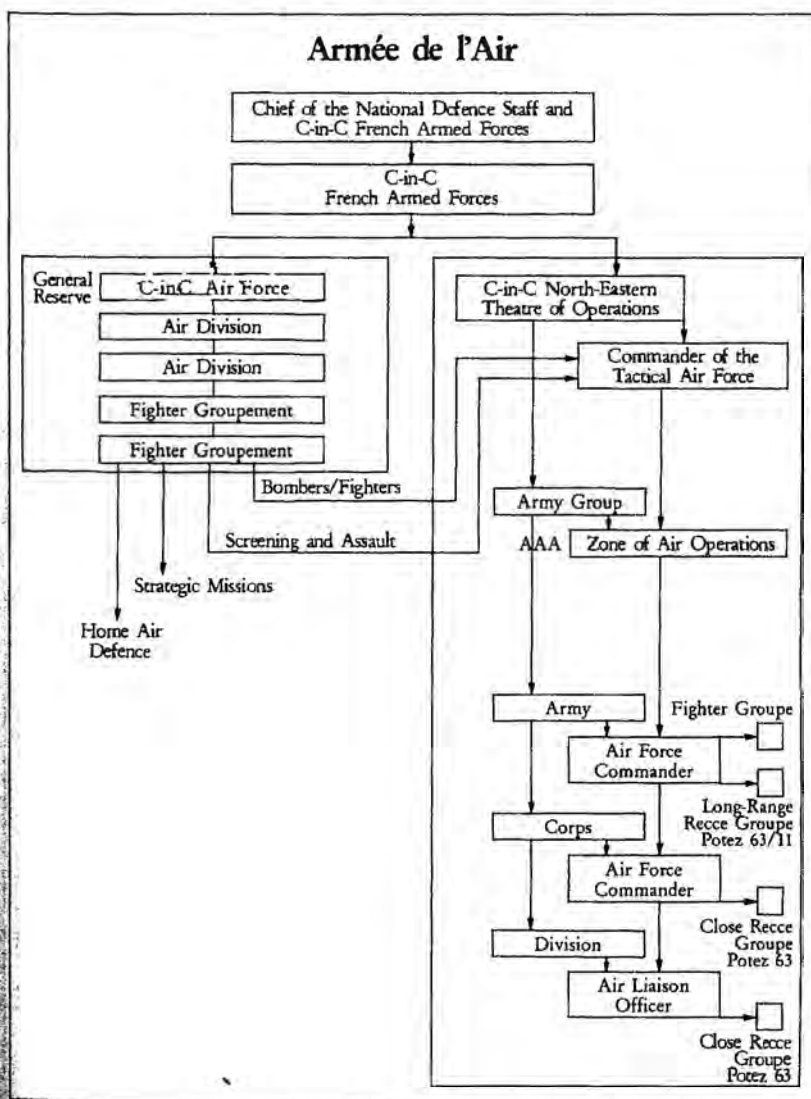
Annexe 2 Operational and territorial organisation of the Luftwaffe in 1939





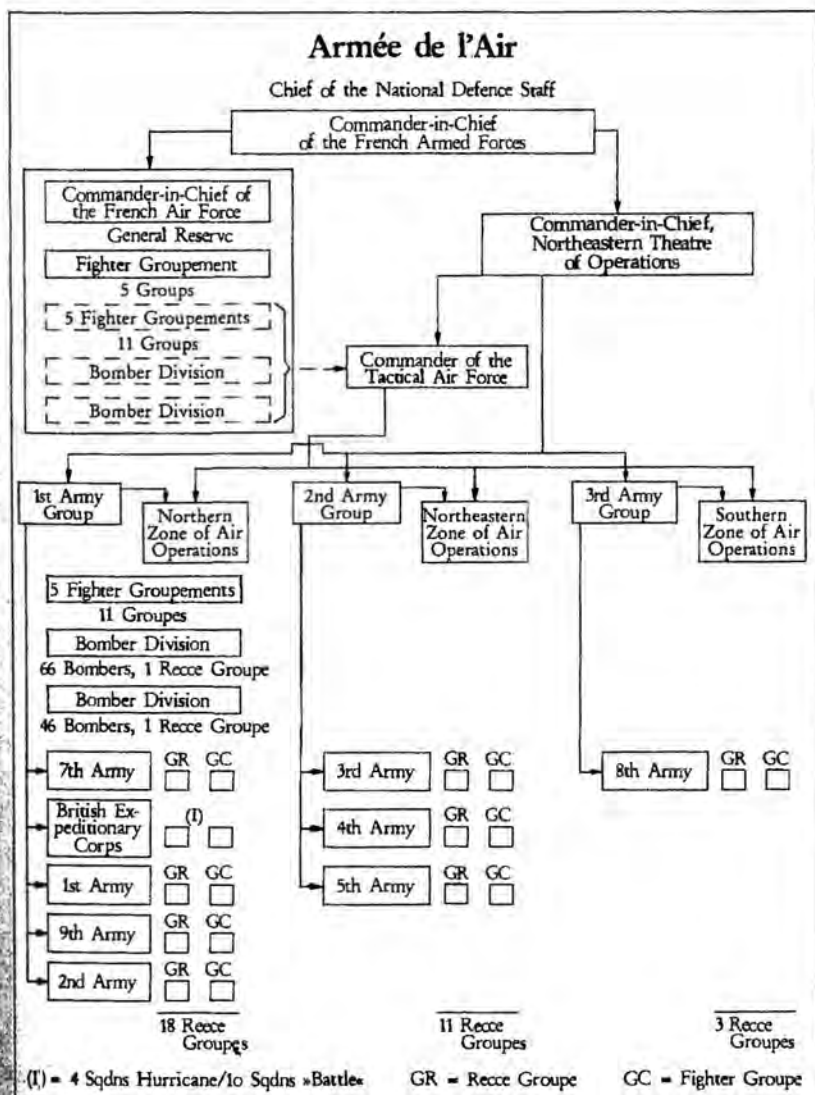


Annexe 4b Organisation of Air-Ground support 1940

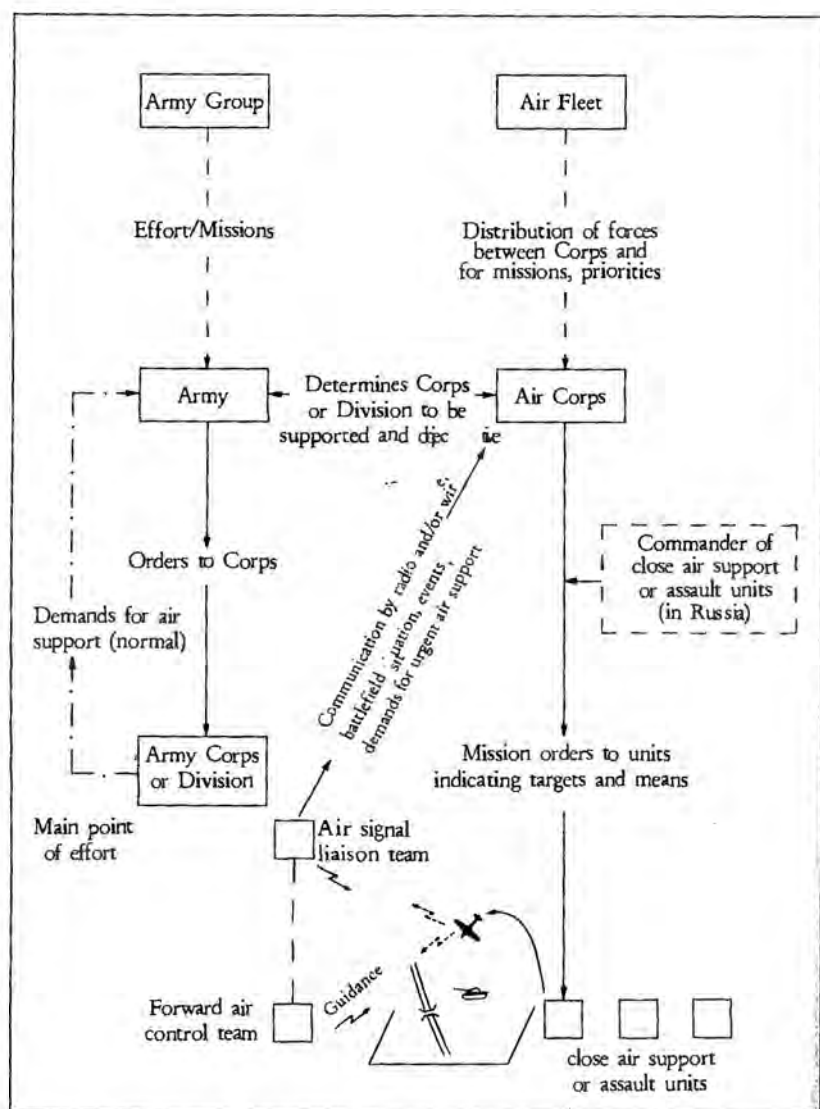




Annexe 5b Organisation of Air-Ground co-operation as of 10 May 1940



Annexe 6 Organisation of close air support of the Luftwaffe



Notes

1. The author suggests translating 'Forces aériennes de Coopération' and 'Aviation de Coopération' as 'Co-operation Air Forces' or 'Air Forces for Co-operation', because, in 1940, they had little in common with 'Tactical Air Forces'. Nevertheless, with this reservation, the latter term is also used here, as it is shorter and more common.
2. It would be wrong to say that France did not see the danger coming: in 1938, there was a clear perception of the threat, and the measures taken at that time were impressive, even if they were to prove too late.
3. Instruction Provisoire sur l'Emploi Tactique des Grandes Unités de 6 octobre 1921, Ministère de Guerre, p. 10 f. Archive du Service Historique de l'Armée de l'air (SHAA), Vincennes.
4. Ibid., p. 24, § 15 and 17.
5. Ibid., p. 12, Rapport au Ministère. 'At night' ... this was to take little account of the massive deployment (300 to 500 aircraft) BY DAY against troops on the ground during our offensives in the summer of 1918.
6. Charles de Gaulle, *Vers l'Armée de Métier*, Paris, 1934, p. 114.
7. Ibid., pp. 167 ff., 180.
8. 'Instruction sur l'Emploi Tactique des Grandes Unités du 12 août 1936, approuvé par M. Daladier, Ministre de la Défense Nationale et de la Guerre', Archive SHAA.
9. Ibid., pp. 15, 17.
10. The importance of 'the offensive' is taken up again, for all forces, contrary to the preceding doctrine of 1921.
11. 'Instruction sur l'Emploi Tactique', p. 51. Following quotations on p. 132 f.
12. 'It is only at particularly critical moments that the light defensive air forces [fighters] would intervene, in an exceptional manner on the ground, with their machine-guns. ... This mission exposes them to very rapid wear and may only be ordered in exceptional cases.' (Règlement de Manoeuvre de l'Aviation, 4ème partie. Ministère de l'Air/Etat-Major de l'Armée de l'Air. Fourth edn, Paris, 1937, § 53, p. 41. Archive SHAA).
13. Instruction sur l'Emploi Tactique des Grandes Unités Aériennes approuvée par M. Pierre Cot, Min. de l'Air, le 31 mars 1937, pp. 17 ff, Rapport au Ministre, Archive SHAA. The following quotations are from pp. 72 f., 82 ff.
14. True at the level of polemics - but in actual fact, in 1940, the Air Force was not sparing with its support to the ground forces, as we shall see later.
15. Charles Christienne and Pierre Lissarague, *Histoire de l'Aviation Militaire Française*, Paris-Limoges, 1980, p. 339 f.
16. The problems of co-operation between the Air Force and Army and between the Air Force and Navy were treated in Germany on the basis of the same principles. We shall limit this analysis to co-operation between the Air Force and Army.
17. Karl-Heinz Völker, *Die deutsche Luftwaffe 1933-1939. Aufbau, Führung und Rüstung der Luftwaffe sowie die Entwicklung der deutschen Luftkriegstheorie*, Stuttgart, 1967, p. 198.
18. 'Truppenamt der Heeresleitung': *de facto*, the embryo of a future 'General Staff' (the latter having been dissolved by the Treaty of Versailles), and created by von Seeckt in July 1919.

19. Völker, *Luftwaffe*, p. 198.
20. Ibid.
21. Luftwaffendienstvorschrift 'Luftkriegführung' (L. Dv. 16), Berlin, 1940, Introduction.
22. 'Tactical', in the German sense, refers to the zone of close air support.
23. Völker, *Luftwaffe*, p. 198.
24. Capitalisation by the present author.
25. General der Flieger Paul Deichmann, *German Air Force Operations in Support of the Army*, USAF Historical Studies No. 163, Maxwell Air Force Base, Ala., June 1962, p. 89, Archive SHAA.
26. Ibid., p. 93.
27. Horst Boog, *Die deutsche Luftwaffenführung 1935-1945. Führungsprobleme - Spitzengliederung - Generalstabsausbildung*, Stuttgart, 1982 (hereafter cited as Boog, *Luftwaffenführung*), p. 174.
28. Ibid., p. 172.
29. Ibid., p. 196.
30. The creation of the 'Luftflotte Reich', which was intended to unify the air defence of the Reich, took place on 17 January 1944 (see Boog, *Luftwaffenführung*, p. 132).
31. Directive No. 21, 'Operation Barbarossa', 18 December 1940 (role of the Luftwaffe): 'In order to be able to employ all its forces against the enemy's air forces and for the benefit of the DIRECT support of the Army, the Luftwaffe must not attack any centre of the arms industry during the phase of principal operations.' The strategic role of the Luftwaffe was thus overshadowed right from the outset. *Hitlers Weisungen für die Kriegsführung 1939-1945. Dokumente des Oberkommandos der Wehrmacht*, ed. Walter Hubatsch, Munich, 1965, p. 100.
32. The number of Air Fleets - and their size - increased in the course of the war, especially from 1941 onwards (Russia) - cf. Annexe 3. Likewise, from 1939 onwards, it was intended to establish additional *Luftgawe* as the Air Fleets expanded.
33. In fact, the time allowed thanks to the 'phony war' permitted the change of organisation to operate without problems.
34. In French: 'Commandant des Forces Aériennes et des Forces Anti-aériennes mis à la disposition du Général Commandant en Chef des Forces Terrestres sur le Front du Nord-Est', in abbreviated form 'Commander of the Tactical Air Force' ('Aviation de Coopération'). This is how we shall refer to him for the remainder of this study, limited to the French organisation at the principal Theatre of Operations, i.e. the north-eastern. Reference to the creation of this position: 'General Operation Order No. 21, 22 February 1940 - signed General Vuillemin. Archive du Service Historique de l'Armée de Terre (SHAT), Vincennes.
35. Boog, *Luftwaffenführung*, pp. 341-5.
36. Two kinds of reconnaissance units were thus assigned to the major Army units: the 'Aufklärungsstaffel - H-' at corps and division level (Hs 126); and the 'Aufklärungsstaffel - F-', long-range reconnaissance units, usually equipped with Do 17s.
37. Cf. Annexe 4a. The arrows marked 'Fighters' or '(Close Air) Support' do not enter the rectangle symbolising the 'Army' field of responsibility for employment.

French and German Army-Air Force Co-operation

38. Cf. the structure of the 'tactical air forces' - Annexe 4b, under the command of the Commander of the Tactical Air Force, himself subordinate to the Theatre Commander. It should be noted that General Vuillemin, thoroughly playing the co-operation game, from 10 May placed almost all his Reserved Forces under the command of the Commander of the Tactical Air Force (cf. Annexe 5b).
39. The strategic reconnaissance *groupes* were equipped with Potez 637s and Bloch 131s and 174s.
40. 'Règlement de Manœuvre de l'Aviation' (as in note 12), p. 41, para. 53.
41. Only naval aviation developed the dive-bomber: Loire-Nieuport 411, which slightly resembled the Stuka, but had a retractable undercarriage; speed 250 km/h; 1 × 20 mm cannon/2 machine-guns/bombs. Poorly armoured, the aircraft proved very vulnerable. Two squadrons were employed in May 1940.
42. The organisation was to evolve rapidly, the *Luftgau* being too restricted.
43. Four regiments per Flakkorps; 3 heavy Flak battalions (*schwere Abteilung*) and 1 light Flak battalion (*leichte Abteilung*) per regiment. Heavy battalion: three 88 mm batteries, or 12 pieces, and one light 20 mm battery, or 36 pieces - or 63 with the advent of the 20 mm four-barrelled gun. Total per Flakkorps: 150 88 mm guns and between 500 and 700 20 mm pieces. Cf. Horst Adalbert Koch, *Die Geschichte der deutschen Flakartillerie 1935-1945*, Bad Nauheim, 1954, pp. 30-5, 116 f.
44. *Ibid.*, p. 26.
45. Christienne and Lissarague, *Histoire de L'Aviation Militaire*, p. 339.

22

The US Army Air Forces and Tactical Air War in the Second World War

Lee Kennett

Operation Overlord, the Allied invasion of Northern France, may well have been the most significant application of tactical air power in the Second World War. Certainly it was the most spectacular: on the single day of 6 June 1944 Allied aircraft made more than ten thousand sorties in support of the landings. The American contribution was an impressive one, involving 8,000 aircraft. At the time of Overlord the United States had been in the war for two and a half years. While the Army Air Forces had amassed great resources, they still had not fully mastered the use of air power in conjunction with land forces; what lessons they had learned in this regard had often come through painful experience. The American air forces of the Second World War are chiefly remembered today for their strategic operations: their tactical effort is less well known. But that story is an instructive one for the historian of air power, as I believe this chapter will show. Since the subject is vast and the available space limited, I will speak chiefly about problems of air-ground co-operation as they manifested themselves in the European theatre of operations.

The US Army Air Forces of the war years were largely a projection or extension of their pre-war predecessor, the US Army Air Corps. In the realm of *matériel* the inheritance was striking. Every type of aeroplane used in the war – more than a hundred different models – was either in existence or under development at the time of Pearl Harbor. Doctrinally the heritage was also an important one, and sometimes a debilitating one.

In a sense there was not one Air Corps in the 1930s, there

were two. There was first of all the Air Corps as its parent, the United States Army, perceived it: an air arm which, while it might have an autonomous strategic mission, was no less an ingredient in land warfare. Some elements of the Air Corps worked almost exclusively to contribute to victory on the ground, others only occasionally, but all could be mobilised for the land battle, which the Army saw as the crucial battle; as the saying went, when the infantry loses, everybody loses. These views found official expression in a number of training manuals, field manuals, and other publications of the inter-war period.

Then there was the other view of the Air Corps, one probably held by most American airmen in the 1930s. This view was most effectively expressed in the teaching of the Air Corps Tactical School, where most of the creative thinking about air power was being done in the 1930s. The school had only minimal interest in the tactical role; indeed one historian has argued that it 'frowned upon the support of the ground forces'.¹ The tactical role was in conflict with another conception of air power. In 1939, a lecturer at the tactical school explained the conflict in tactful but unambiguous terms. 'Employment of the Air Force in tactical support of either the land forces or the sea forces may fail to utilise peculiar powers of the Air Force, and generally it will not result in a maximum contribution of the available force toward accomplishment of the national aim.' By the 1930s the 'peculiar power' of the air force seemed to be best utilised in the strategic bombing offensive. To be sure, this was one of the missions given to the air arm in the various Army Manuals. But in the hearts and minds of many American airmen it came to be a *raison d'être*, an article of faith. The faith was strengthened in 1935 with the appearance of a strategic bomber of remarkable promise – the B-17.

By the 1930s one could also say that there were two Air Corps in the physical sense. Observation aviation was placed at the disposal of ground units; then there was attack aviation, specialised in direct and indirect support of ground forces. These elements represented the Air Corps' contribution to the land war. The fighter and bomber units, on the other hand, were primarily concerned with the air war. This dichotomy was an easy one to perpetuate in the 1930s; Army and Air Corps units were scattered about the country on isolated posts and bases. Appropriations for even the most modest training exercises were difficult to obtain; not until 1941 were there manoeuvres with two army-sized 'teams'. Isolation and insularity had

another dimension: lessons about tactical air warfare that might have been learned in foreign conflicts of the 1930s were ignored. This happened partly from lack of knowledge of what was happening abroad; as a case in point, no American military observers were sent to Spain during the civil war there.

The result of this state of affairs was a neglect of tactical aviation.² Institutions, like individuals, rarely do many things equally well. The Air Corps tended to commit its resources and its best minds to solving the problems of strategic bombing. Tactical arms such as observation and ground attack were in a sense abandoned to the Army – indeed the Air Corps sometimes referred to its observation units as ‘orphans’.³ The Army, pre-occupied with its own affairs, gave little impetus to the development of these arms.

During the war the effects of this neglect were to become apparent both in *matériel* and doctrine. While the Air Force used two generations of strategic bombers in the Second World War, and would have introduced a third had the war lasted another year, it never developed a satisfactory plane for light observation and liaison, nor was a satisfactory military transport created before the end of the war.⁴

The correct aircraft for ground attack was never clearly identified.⁵ Doctrinally, the airmen of the attack squadrons worked in a void. They devised their own tactics, which were never incorporated into a tactical manual. They carried out experiments that apparently were not recorded or passed on.

Then winds of change began to blow late in 1938, after the Munich accords. President Roosevelt was convinced that the weakness of the French and British air forces had compelled those powers to make concessions to Hitler. Roosevelt launched an armament programme which heavily stressed aviation. Once begun, the new programme escalated rapidly. In the summer of 1940 the Air Corps found itself deluged with money; its chief, General H. H. Arnold, recalled: ‘In forty-five minutes I was given \$1,500,000,000 and told to get an air force.’⁶

The cause of this massive appropriation was the spectacular German victory in France and the Low Countries, which delivered a profound shock to American political and military leaders.⁷ The US Army’s high command found the secret of Germany’s victory in the combined use of armour and the Junkers Ju-87 dive-bomber; it resolved to supply American forces lavishly with this Blitzkrieg weaponry.

Plans were prepared for the formation of fifty armoured

divisions and large numbers of dive-bombers. The Air Corps opposed such aircraft, which it felt were too vulnerable. But when an Air Corps officer submitted its eighty-four-group expansion programme to Army Chief of Staff George C. Marshall, General Marshall told him bluntly 'I will not approve your program until the success of the Ju-87 is reflected in it. I want to see aircraft, significant in number, of the Ju-87 type.'⁸ The plan was approved, with twelve of the eighty-four groups designated for dive-bombers.

The issue was soon resolved when the Army gave up plans for fifty armoured divisions. Only sixteen such divisions were created, and only a limited number of dive-bombers were built. But the disagreement between air and ground leaders was soon transferred to other matters, among them the control of observation and reconnaissance aircraft, the nature of the intelligence obtained by them, and the priorities in seeking and exploiting that intelligence. These quarrels in the Pentagon were fuelled by complaints of ground commanders who felt they were poorly served in reconnaissance. Though they had less to complain about in the last months of fighting, to the end of the war the ground arms sought their own observation and liaison planes, while the air arm sought a monopoly on everything that flew.⁹

Then there was the long search for a general formula governing the relation between ground and tactical air forces. After much casting about and many trials and tests, British and American experience in North Africa and views of British generals became the basis for Field Manual 100-20, 'Command and employment of Air Power', issued in mid-1943. The manual seemed to many ground officers a declaration of independence on the part of the Air Force. A preamble in capital letters proclaimed: 'Land Power and Air Power are co-equal and inter-dependent forces; neither is an auxiliary of the other.'¹⁰

FM 100-20 went on to stipulate that air power in the field would be under centralised command and control, and exercised by an air-force commander. Superior ground commanders were prohibited from attaching air units to units of the ground force. Air support would be supplied through co-operation, in an integration of efforts, not of forces.

This text was adopted without the accord of Army Ground Forces, whose chief, Lieutenant General Lesley J. McNair, generally offered the most outspoken opposition to the Army Air Forces point of view. Among ground officers there was a fear that the Air Force might neglect the ground war, encouraged by

the statement that first priority should go to establishing air superiority, second priority to isolating the battlefield, and third to direct support of the ground forces.

The 'co-equal' principle seemed debilitating. A War Department campaign study of 1943 concluded: 'The ability to strike one great blow with all available means requires quick decision, accurate timing, and prompt execution; it is the ultimate function of command, not of co-operation.'¹¹ The doctrine of co-operation remained the guiding principle governing air-ground relations, and the Army's unhappiness with it continued. After the war an Army spokesman argued: 'As a fundamental military command arrangement, cooperation can be a dangerous thing We are afraid of it.'¹²

What can be said of air-ground relations of American Forces during the Second World War? Basically that they worked; though they were never perfect, they tended to be better as the war progressed, and the two partners learned what to expect of each other. Here command relationships were also personal relationships, and they were not always good. General Dwight Eisenhower took an instant dislike to General James Doolittle, who was to head the Air Forces in the North African campaigns; Doolittle was soon replaced. By contrast the relations between General Douglas MacArthur and his air commander, General George C. Kenney, were excellent. Kenney told an interviewer long after the war why he got along well with MacArthur: 'He didn't know anything about aviation . . . [but] he would appreciate anything that worked.'¹³

In the European theatre good relations between the Army commander and Tactical Air Command leader paired with him were crucial to air-ground co-operation. General Otto P. Weyland, whose 19th Tactical Air Command supported General George Patton's Third Army, recalled: 'we achieved a rather basic understanding. Expressed very simply, it was that he would run the ground forces and I would run the air forces.'¹⁴

As a rule, when air-ground teamwork proved defective, there were any number of reasons for it, but rarely did ill-will or enmity figure among them. To be sure, there were lingering differences over the nature of air support. The air commander believed that the best way to protect friendly ground forces from hostile air action was to seek out the enemy's aircraft aggressively on the other side of the line, challenging him to defend his own airspace, striking his airfields. The ground commander thought more in terms of an aerial umbrella, with friendly

aircraft quickly available to drive off intruders. There were also fundamental differences over the use of air power against ground objectives. The air commander liked centralised command and control, usually at the tactical air command level, which allowed air power maximum flexibility; he tended to use his aircraft on objectives that would have a general, if gradual effect on the evolution of the land battle. The ground commander wanted air support 'here and now'. An Air General complained; 'ground force commanders are so close to the action that they inevitably take the short sighted view . . . If you offered a battalion commander a choice of air action which would save him a thousand men a week from now and one which would save him ten men tomorrow, he would invariably say "save me the ten men tomorrow"'. Although this is human nature, it is not the way to win wars.¹⁵

From battalion level down, ground officers – and their men – believed in air support they could see and hear. A post-war study found that when the bomb line was too far forward, 'army forces tend to lose faith in their air support'.¹⁶ How close should close air support be? In the early years it was not very close. There was a tradition from Air Corps days that enemy troops in the combat zone were not a 'profitable objective for air attack', and that generally the more suitable targets lay beyond artillery range. There was another consideration: the danger of mistakenly attacking friendly troops. This did happen, and it was not without some justification that American infantrymen in Europe called the 9th Tactical Air Force 'The American Luftwaffe'. Before the Normandy invasion it was the custom in the European Theatre for American planes to attack objectives only if they lay more than a thousand yards from American front-line positions. But on the Normandy bridgehead aircraft had to do the work of artillery for a brief time, and thereafter the tendency was to attack objectives in closer proximity to friendly troops.

Centralised control of air forces might make best use of the aeroplane's extreme mobility, but in the eyes of many ground commanders it took too much time to process requests for air strikes; they would have preferred aircraft held locally and 'on call'. Officers in North Africa complained that when they encountered German forces it took two hours to get air support, while German Stukas would be over their heads within twenty minutes.¹⁷ Time was most critical where forces were moving rapidly in open country; in the slow-moving fronts of the Pacific jungles response time was far less important. Here again the

general impression is of improvement, particularly from 1944 on, as communications improved and battle experience paid its dividends.

The year 1944 saw great expansion in ground-support activities. From July on, American armoured units were supplied with 'armoured-column cover', from three to twelve fighter-bombers which accompanied advancing columns and were in direct communication with them. Increasing numbers of aircraft were assigned armed reconnaissance missions which sent them out on a hunt for targets. Strategic bombers were used from time to time on targets of an essentially tactical nature. By that time the versatility of aircraft was well established in the US Army Air Forces. The fighter-bomber was nearly two years old: fast combat craft were adapted for reconnaissance (in the Pacific, where distances were great, four-engined bombers did reconnaissance.) Commercial aircraft had been adapted for use as transports and light observation and liaison planes. But versatility had its limits, and tactical employment of strategic bombers rarely gave the results hoped for. Post-war analyses found their missions against German defences in Normandy 'not unqualified successes'.¹⁸ Their use before Brest was found to be 'wasteful and ineffective'.¹⁹

We should note that the increased tactical activity came partly because of a simple abundance of aircraft – in July 1944 the US Army Air Force had some 80,000 planes on their inventories.²⁰ This relative wealth permitted lavish commitment of air resources to tasks that would earlier have been judged unprofitable and contrary to doctrine. And while American air power grew, German and Japanese aviation declined. After 1944 the battle for air superiority was largely won, so a greater proportion of missions could be dedicated to more direct benefit to the land forces.

Finally, much of the success of American aviation can be attributed to its ability to abandon quickly what did not work, by its willingness to borrow from its allies and its enemies, by its ability to adapt and to improvise. But efforts and achievements more often involved solving immediate problems than anticipating future ones. There was no single organism to think creatively about air power, to consider in detached, clinical fashion the potentials of new weapons, the challenges of future campaigns. The old Tactical School had done this, but in the rush to rearm, to 'catch up', this function had been largely lost. A new School of Applied Tactics was launched in the middle of the war, but its wartime role was minimal.

As a consequence, when it became apparent in 1944 that the German Army was using the hours of darkness to move with virtual impunity, very little could be done about it in the short term. The inability to conduct night-time tactical operations was the chief weakness of American aviation in the closing months of the war. By the end of 1944 night-intruder operations were being hastily improvised; but in war, as in most human endeavours, improvisation is a poor substitute for foresight.

Notes

1. Joe Gray Tylor, 'They Taught Tactics', *Aerospace Historian*, XIII, No. 2, Summer 1966, p. 71.
2. General James H. Doolittle recalled in this connection: 'I must admit in all honesty that we were oriented more towards fighters and bombers than we were towards ground support.' See his oral history interview transcript, 26 September 1971, United States Air Force Historical Research Center, Maxwell Air Force Base, Ala. (hereafter USAFHRC), K239.0512 793, p. 51.
3. Robert Futrell, *Command of Observation Aviation: A Study in Control of Tactical Air Power*, USAF Historical Studies, No. 24, Maxwell AFB, Ala., 1956, p. 3.
4. *Ibid.*, pp. 4-5.
5. Wesley Frank Craven and James Lea Cate (eds), *Men and Planes*, Vol. VI, *The Army Air Forces in World War II*, Chicago, 1955, pp. 221-5.
6. Quoted *ibid.*, p. 13.
7. See in this connection Lee Kennett, 'Le haut commandement aérien américain et la bataille de France', *Revue Historique des Armées*, No. 168, September 1987, pp. 9-16.
8. General Orvil A. Anderson, 'Editorial Note', *Air Power Historian*, XII, No. 3, July 1965, p. 89.
9. See in this connection Kent Roberts Greenfield, 'Army Ground Forces and the Air-Ground Battle Team, Including Organic Light Aviation', Historical Section Army Ground Forces, Study No. 35, 1948, typescript in US Army Military History Institute, Carlisle Barracks, Pa., pp. 58-67.
10. FM 100-20, *Field Service Regulations, Command and Employment of Air Power*, 21 July 1943, p. 1.
11. War Department, Military Intelligence Service, *Notes and Lessons on Operations in the Middle East*, Washington, 30 January 1943, p. 24.
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13. General George C. Kenney, transcript of oral history interview, 19-21 August 1974, USAFHRC, K239.0512 806, p. 8.

14. General Otto P. Weyland, transcript of oral history interview, no date, USAFHRC, K239.0512 798.
15. Major General William L. Kennedy, transcript of oral history interview, 14 September 1961, USAFHRC, K239.0512 794, p. 56.
16. 'The Ninth Air Force and its Principal Commands in the European Theater of Operations, 1945', typescript in USAFHRC, Vol. II, Part I, p. 123.
17. See on this campaign Daniel R. Mortensen, *A Pattern for Joint Operations: World War II Close Air Support, North Africa*, Historical Analysis Series, Washington, 1987, *passim*.
18. Juliette A. Hennessy, *Tactical Operations of the Eighth Air Force, 6 June 1944-8 May 1945*, Maxwell AFB, 1952, p. 154.
19. *Ibid.*, p. 62.
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23

Theory and Practice of the Air War: The Royal Air Force

John Terraine

The Royal Air Force was born, institutionally, on 1 April 1918: for the practical purposes of military aviation, I would suggest that a better date would be 13 August 1914, when the first three squadrons of the infant Royal Flying Corps flew across the Channel into the theatre of war – a first occasion in history if ever there was one. A few days later, they were followed by an organisation known as the Aircraft Park, bringing spare aircraft in crates, spare personnel and mobile workshops. The RFC then became truly functional, because as the Official History says, this was 'the original . . . nucleus of that vast system of supply and repair which supported the squadrons operating on the Western Front and kept them in fighting trim'.¹

The Western Front was the decisive location of the First World War (as the Eastern Front was in the Second) so there could not have been a more significant station for the RFC. From the very beginning its work was of great importance, and it became more so with every month that passed. Very quickly the First World War declared itself to be an artillery war, in the sense that it was artillery that decided battles, and artillery that inflicted the great majority of the casualties which have so horrified succeeding generations. The same was, of course, true in the Second World War, but it took until about 1943 for the fact to be acknowledged.

In the 1914–18 artillery war the role of aircraft became vital. The great problem, in those early days before radio-telephony, was evidently communication between observers in the air and batteries on the ground. The air had two main functions: location and notification of targets for the batteries, and observing and correcting their shooting. The first function took a long step

forward in the British Expeditionary Force when Lieutenant D. S. Lewis introduced squared maps as early as September 1914, and these were soon universally adopted; and then, in January 1915, on the prompting of Captain B. T. James, Lewis also devised a clock code to indicate the fall of shot. By March 1915 (the Battle of Neuve Chapelle) aerial photographic reconnaissance was providing trench maps giving exact information of enemy positions, with particular attention to enemy batteries. It was already considered pointless – on the Western Front, at least – for artillery to operate without air backing, and days when bad weather prevented flying were considered bad days indeed.

Communication with infantry, especially infantry trying to advance in battle, remained a virtually insoluble problem in both wars, though many solutions were tried both in 1914–18 and 1939–45. By 1916, however, air co-operation with artillery was coming to a high pitch of perfection; by 1917 it was commonplace for 'Now Firing' calls from aircraft to bring counter-battery artillery into action against concealed enemy batteries as soon as they came into action – and an alert enemy was not slow to create a listening service to pick up those calls and warn the batteries in question. All this was standard drill by the time of the Battle of Messines in June 1917; the bad weather of much of the Third Battle of Ypres had a ruinous effect on artillery programmes, but when the weather improved in September, in the Battle of the Menin Road Ridge, 394 calls from aircraft were instrumental in breaking up every German counter-attack before it could be fairly launched. The same technique made the next two battles also very successful occasions for the British.

The real triumph of 1917, however, which put a mark on all the rest of that war, was the introduction of Predicted Shooting. This was first carried out by the Germans at Riga, and then by the British at Cambrai, a battle which is usually thought of as the day of triumph of the tanks. So it was, but it was also the day of triumph of a magnificent co-operative enterprise between the Royal Engineers and the Royal Flying Corps to produce a new, accurate map of the Western Front on a scale of 1:20,000 which became the basis of the 'artillery boards' supplied to all batteries. Thanks to this it was possible for artillery to open fire at Zero Hour without previous registration and correction – thus at last restoring the long-lost element of *surprise* to battle. Thanks to this map and the technique of calibration, guns could now fire at targets instead of landscapes, thus adding the element of *pre-*

cision. The addition of smoke shell, now plentiful, gave the advancing infantry *protection*, as well as a marker to show it the way, and it was these three factors – surprise, precision and protection – which finally unlocked the trench-bound battlefields and brought manoeuvre back into war in 1918. The contribution of the RFC and its successor, the Royal Air Force, was clearly of the highest importance.

One might suppose that all this would have left imperishable lessons, both for the Air Force and the Army. Unfortunately the First World War produced a national trauma in Britain, an impression of utter disaster, of something in all respects best forgotten. The consequence was that this excellent battle-system was not properly revived in the British Army until 1942, while as for the Air Force, as Sir Maurice Dean wrote, 'Between 1918 and 1939 the RAF forgot how to support the Army.'²

Since it turned out that the RAF had also forgotten how to support the Navy, the question arises, what did the RAF think it was for? And that question is, of course, no sooner asked than answered. It should never be forgotten that the Royal Air Force itself was born of a 'strategic air offensive' – the offensive launched by the German Air Force in May 1917, using two new (and for their time, very formidable) aircraft: the G-IV and G-V 'Gothas', with their 500 kg bomb-load, and somewhat later the Staaken Zeppelin-Werke R-VI 'Giants', whose wing-span was only one metre less than that of a B-29 Superfortress of 1943, and whose bomb-load was 2,000 kg.

The attack on British cities by these aircraft was not, by Second World War standards, particularly destructive of life or property: 619 civilians were killed and 1,650 injured in the aeroplane raids, and £3 million's worth of damage was done. But the effect on the morale of the population and on the government was enormous.

As the Chief of the Imperial General Staff remarked, 'one would have thought the world was coming to an end',³ and somewhat later a sardonic military commentator wrote: 'Moral – always bomb the seat of Government.'⁴ A committee headed by a member of the War Cabinet, the South African General Smuts, was set up to examine the whole question of Air Organisation and Home Defence, and it was out of the findings of this committee that the Royal Air Force was given birth.

Already the attempt was being made to match the German performance with a British air offensive against Germany, and in June 1918 the Independent Force, the Royal Air Force, came

into existence under Major-General Sir Hugh Trenchard – and that, too, was a date in history. In the few months of war remaining, the Independent Force actually caused fewer casualties and less damage than the Germans over Britain; but again, the moral effect was considerable, and Trenchard himself stated that: 'the moral effect of bombing stands to the material effect in a proportion of 20 to 1.'⁵ This belief was to become a foundation-stone of RAF strategic thinking thereafter.

The pursuit of a strategic offensive as a substitute for the existing modes of waging war, the deep faith in the effect of aerial bombing, and the equal faith that, in Prime Minister Baldwin's famous phrase, 'the bomber will always get through',⁶ took on the attributes of religious dogma. It may be said, without straining verity, that bombing was what the RAF was all about. Some concession had to be made to government and civilian fears, some fighter squadrons had to appear in the order of battle in the hope of making life difficult for enemy bombers and emulating the feats of the First World War 'aces', but bombing was what the RAF understood by air warfare, and bombing was what it intended to perform. It is chiefly for that reason – with the usual admixture of inter-service political infighting at various times – that co-operating with the Army and the Navy went right out of fashion between the wars. And while some soldiers and possibly a handful of sailors – but they would be hard to name – regretted the loss, it has to be said that neither the Army nor the Navy showed any strong sign of being grieved. As far as the Navy was concerned, its chief desire was to obtain the return of its own air force, as in the days of the Royal Naval Air Service, for its own special purposes, mainly the protection of the Fleet in battle. So the fight for the Fleet Air Arm was all that mattered, and when that fight was won in 1937 it appeared to be the end of the Navy's air problem.

The constant refrain of both the champions and the enemies of air power in the 1920s and 1930s was the prospect of what became known as 'the knock-out blow'. It was the idea of being able to deliver a crushing blow to enemy industry and transportation – striking directly at the very means of waging war, instead of merely engaging armed forces – that enthused the air power prophets. This was to be the new style of warfare; this was the language of the future. To that extent it was very welcome in Britain, because the still fresh memory of what had happened between 1914 and 1918 aroused general revulsion. Above all, it was the static and very costly war of masses on the

Western Front that aroused disgust (what Adolf Hitler called 'a degenerate form of war').⁷ The British had been appalled at the human cost of that style of war, 'degenerate' or otherwise, and anything that seemed to offer an alternative was viewed with satisfaction. So the critics of the First World War lined up on the side of air power, with its promise of a short, sharp conflict in which, supposedly, bricks and mortar might prove to be the chief sufferers. The politicians, sensing the national mood, also inclined to varying degrees of belief – and varying degrees of apprehension – in regard to the theory of the 'knock-out blow'.

The Treasury, seeking to cut military expenditure by every possible means, approved of the Air Force as an economical alternative to a conscript army and a big battle fleet. The RAF, in other words, did not lack friends. There were opposing voices, however. Alongside the plain revulsion at the bloodshed of the First World War there was a growing wave of Pacifism and Internationalism, preaching disarmament and collective security through the League of Nations.

Among the supporters of these ideas, the 'knock-out blow' was considered a final outrage against humanity, and the dread of it turned literally millions of honest well-meaning citizens into supporters of Appeasement – or anything that promised to keep the bombers away. The output of science fiction, embroidering themes long since made familiar by writers like H. G. Wells, and now all too real and illustrated by the imaginative devices of the cinema, preyed on the public mind with images of universal destruction by terrible explosives and universal death by terrible chemicals. There was, in consequence, a degree of hysteria attaching to the subject of air bombardment, and a degree of unreality in the anticipation of another war – a likelihood which became more and more certain as the 1930s wore on.

The extreme danger of accepting dogmas seems to me to be illustrated by the almost incredible failure of responsible persons in Britain to take due note of the actual air warfare that was taking place at that time. In 1932 the Japanese bombed Shanghai, and people paying their weekly visit to the cinema to watch Marlene Dietrich or Tarzan or Shirley Temple were able to see in the newsreels bombs falling and smoke rising from the ensuing explosions. It was an impressive spectacle. Accurate military analysis of these scenes, to obtain any exact notion of what was happening – how many aircraft, how many tons of bombs dropped, how many casualties, how many killed, how much

damage, etc., etc. – was clearly in the circumstances no easy matter, probably just impossible. I would like to have found more evidence that anyone really tried.

The air-power champions saw the Japanese example as proof of their theories; their opponents saw ample justification for their laments. The World Disarmament Conference in Geneva spent fruitless hours and wasted incalculable quantities of breath trying to work out ways of abolishing air warfare – only to find that the only way of doing so would be to abolish aircraft altogether, a difficult proposition, even for the most fanatical disarmers.

One fact about the Japanese war in China does obviously stand out, and might have dawned on observers even at the time, but did not. The fighting at Shanghai began in February 1932: as each month went by it became more clear that whatever else might be happening there, what was *not* happening was a 'knock-out blow'. Nearly ten years later, when Japanese naval aircraft attacked Pearl Harbor, the cities of China had accumulated a considerable experience of air bombardment – but China was still in the war. That fact appears to have been considered unworthy of remark in the arguments about the 'knock-out blow'.

Just over four years after the first Shanghai air raids, the Spanish Civil War broke out, and once more the world was treated to the spectacle of cities under air bombardment, this time with substantial press coverage and some very striking newsreel film to illustrate the reportage. Madrid was a beleaguered city for nearly three years, and under some degree of air attack for most of that time; Barcelona was also heavily attacked, the attacks in March 1938 causing casualties not very different from Britain's in the whole of the First World War. The civilian air-raid deaths in the entire Spanish Civil War amounted to about 14,000 in the Republican area, with about another 1,000 in the Nationalist zone⁸ – the total is roughly 3 per cent of the full total of people killed in the war. Obviously, this was a long way indeed from anything resembling a 'knock-out blow' – no such thing had occurred, but what had occurred was a very considerable air contribution to the land battles by both sides, probably decisive in the later stages, when the Nationalists compensated a serious shortage of artillery by the use of German bombers of the Condor Legion. Particularly noted by those who saw them in action were the Junkers Ju 87 dive-bombers, which would be heard of again. Indeed, according to one auth-

ority, it was in August 1938 that 'command of the air had passed decisively to the Nationalists',⁹ after which the issue was never in doubt.

If that is accepted, the Spanish Civil War must be looked upon as the first to be decided by air power. Yet such was the 'knock-out blow' fixation that the British Chief of the Air Staff, Air Chief Marshal Sir Cyril Newall, pronounced in 1937 that this application of air power to land battle was 'a gross misuse of air forces',¹⁰ and there is no evidence of Newall's having changed his mind by September 1939.

It is, as I think must be generally agreed, an astonishing aspect of that fixation that not until the spring of 1938 did the RAF, dedicated since birth to long-range bombing as the chief expression of its power, actually begin to make real plans for the fulfilment of that function. Until then the bombing role – centred, since 1936, on the newly created Bomber Command – was in truth more a matter of pious intention than of military possibility. When we talk of such a matter in terms of the RAF, we are talking of a technical Service which is not to be understood in any other sense. Divorced from its aircraft, the RAF (unlike the Luftwaffe, with its large anti-aircraft component, its paratroops and ultimately its field divisions) ceases to exist.

It was in 1938 that the Nazi entry into Austria and the developing Czechoslovak crisis concentrated British minds upon the stark realities of power – which, in the case of air power, means the machines. Bomber Command, in 1938, consisted of the following:

- 17 squadrons of Fairey Battles;
- 16 squadrons of Bristol Blenheims;
- 9 squadrons of Armstrong Whitworth Whitleys;
- 5 squadrons of Handley Page Harrows; and
- 2 squadrons of Vickers Wellesleys.

The Battles, Harrows and Wellesleys were recognised as obsolete, and were on their way out; the Blenheims never pretended to be anything but short-range aircraft: and as I said in *The Right of the Line*, 'nine squadrons of Whitleys did not make a strategic bombing force'. Yet it was precisely at this time that the Air Staff and Bomber Command were insisting with assurance that by concentrating on 19 power plants and 26 coking plants, by flying 3,000 sorties at an estimated cost of 176 aircraft, the RAF could bring German war-making capability to a standstill. I must say that I find the only possible reaction to British bombing

dogma at that period— and, indeed, right up to 1943— to be one of sheer wonderment. The bomber chiefs seem to have been existing in some mysterious climate, unrelated to geographical, mechanical or numerical reality; knocking out the German war industry in a fortnight with 144 Whitley bombers takes some imagination!

Fortunately, a sharp wind of realism was about to blow. If the Czech crisis, leading to the Munich humiliation, had the effect of concentrating men's minds, there was one mind already present which did not need any great spur. It belonged to Air Chief Marshal Sir Edgar Ludlow-Hewitt, who became Air Officer Commanding-in-Chief, Bomber Command, in September 1937. Ludlow-Hewitt's mind was very penetrating, his eye was very sharp, and he was fearless in presenting his conclusions. It was his belief that war planning was merely hypothetical without operational efficiency, and on taking up his post he at once made it his business to investigate every aspect of the efficiency of his Command in great detail. He presented his report in November 1937 (and a second one in May 1939, not noticeably different in tone); they make astonishing reading, after all the talk of independent air power and 'knock-out blows'. The two documents reveal the RAF's centre-piece, its favourite child, with merciless accuracy on the eve of war. Both reports are couched in very strong terms which leave no possibility of doubt about their purport; two examples will now have to suffice to give the flavour of a long catalogue of identified deficiencies.

First, there was navigation; Ludlow-Hewitt rightly saw this as central to the operational efficiency of Bomber Command. It is to be remembered that at that period there was no idea of the Command's being other than a daylight force — the 1937 flying hours demonstrate that: just under 130,000 hours of day flying, less than 9,000 hours of night flying. So what we are discussing is basically daylight navigation; and since a bomber that does not succeed in finding its target is no bomber at all, this was, as Ludlow-Hewitt saw it, a matter of reaching the target in all weathers; he concluded:

A fair-weather force is relatively useless and is certainly not worth the vast expenditure now being poured out on the air arm of this country. And yet today our Bombing Force is, judged from a war standard, practically useless and cannot take advantage of the excellent characteristics of its new and expensive aircraft.¹¹

He contrasted the capabilities of his pilots with what was already standard practice in civil airlines, whose pilots were

accustomed to flying their aircraft for long periods and for great distances through thick clouds, fog, snow and other adverse conditions. But these pilots depend upon navigational aids and homing devices, combined with an efficient and adequate DF [Direction-finding], meteorological and control organization on the ground, which are at present far from being available to Royal Air Force pilots.

We have to remind ourselves that in 1937 radio equipment was only carried by formation leaders, and instrument panels were only just being introduced; such as existed were still incomplete. It all seems a very long time ago.

Closely linked with navigation in the business of reaching a target was gunnery. It was a fundamental Bomber Command doctrine that a bombing force, in tight formation with its guns mutually supporting, would be able to beat off fighter attacks even in daylight. Amazingly, no one had tested this against the RAF's own modern fighter aircraft. So the shock may be imagined when Ludlow-Hewitt pronounced his final, devastating word on this utterly vital subject: 'As things are at present, the gunners have no real confidence in their ability to use their equipment efficiently in war, and captains and crews have, I fear, little confidence in the ability of the gunners to defend them against destruction by enemy aircraft.'

This was in May 1939, with war only four months off. At that time it was still the case that there was no specialised air-gunner function in the RAF; the gunners in question were ground crew who volunteered for this duty for a pittance of extra pay, when their main duties permitted. Ludlow-Hewitt pressed for the specialisation of all aircrew functions – and much else besides.

The position, as he saw it in May 1939, was well-nigh catastrophic; the Command was 'entirely unprepared for war, unable to operate except in fair weather, and extremely vulnerable both in the air and on the ground.'

Well might the Official Historians, Sir Charles Webster and Dr Noble Frankland, say: '... when war came in 1939 Bomber Command was not trained or equipped either to penetrate into enemy territory by day or to find its target areas, let alone its targets, by night. ... This seems a strange result after twenty years of devoted work.'¹²

It does indeed; it meant, as Webster and Frankland say, that the RAF's most treasured instrument was 'incapable of carrying out the operations on which the Air Ministry had based its strategy for the last four years'. So much for dogma.

It is small wonder that, on the eve of war, relations between the Air Staff and the AOC-in-C of Bomber Command had reached a state of almost open revolt by Ludlow-Hewitt against proposed plans which he now perceived and proclaimed as utterly unreal. There would be no 'knock-out blow'; there was no point in even trying it. And what that meant was that, with war imminent, there was a very real difficulty in finding an effective role for Bomber Command at all. It was a truly extraordinary state of affairs. In the event, after a depressing survey of the options, it was agreed (without enthusiasm) that its daylight task should be naval co-operation after all - attacking the German North Sea Fleet bases - and at night to drop uncounted millions of propaganda leaflets designed, as Churchill tartly remarked, 'to rouse the Germans to a higher morality', and certainly as Sir Arthur Harris equally tartly said, convenient 'to supply the Continent's requirements of toilet paper for the five long years of war'.

It is important to note exactly what Bomber Command represented in military terms as it entered its time of testing. For any strategic (i.e. long-range) purpose its effective strength on 3 September 1939 was:

- 6 squadrons of Wellingtons;
- 5 squadrons of Whitleys; and
- 6 squadrons of Hampdens.

That represents a total of 204 twin-engined aircraft in the initial establishment, of which the Whitley squadrons were already considered obsolescent. But the names are to be noted well; for some years to come, when people spoke of a 'strategic air offensive' against Germany, this was what they would mean: Wellingtons, Whitleys and Hampdens - and very little else.

It is surely rare in history to see a theory of war so devotedly held being so abruptly abandoned without even being tried as the RAF's intended 'knock-out blow' against Germany in 1939. This was a bad blow for the Air Staff, but it was by no means the only one. It was not only Air Chief Marshal Ludlow-Hewitt who was at loggerheads with Air Staff policy; there was also Air Chief Marshal Sir Hugh Dowding, A.O.C.-in-C. of Fighter Command.

Dowding's Command was a thing apart, inasmuch as it con-

tained the two most effective aircraft in the RAF's armoury – the Hawker Hurricane and the Supermarine Spitfire. Both of these were high-performance eight-gun fighters, unquestionably capable of performing the tasks for which they were intended, which was something you could not say for any others. Dowding's problem was a very simple one: numbers. Like Ludlow-Hewitt, he was a realist; he made a realistic assessment of what his Command would minimally require in order to carry out its allotted task, which was to defend Great Britain successfully against air attack. Having arrived at his minimum figure, he fought for it tooth and nail. At every stage, in making every demand, he had to battle with the Air Staff's automatic priority to Bomber Command, which was bad enough; but there was something else as well.

All through the inter-war years governments, the Treasury, pacifists of all kinds, military 'experts', and air marshals had set their faces against another 'Continental Commitment' of the kind that had taken Britain to war in 1914, that is to say, a French alliance and an expeditionary force. The fashionable slogan of the 1920s and 1930s had been 'Never Again', and a very silly slogan it was, because to possess any meaning it would have to have the consent of potential enemies, which could be difficult to obtain. In 1939 the truth became apparent; once again Britain was about to be engaged in a coalition war on the Continent – and once that was accepted politically the strategic consequences followed.

Obviously, as in 1914, there would have to be another British Expeditionary Force (BEF), but unlike the 1914 article, this one would require immediate large-scale air support. This support was at first seen as taking the form of the Westland Lysander, built specifically for the reconnaissance role of Army co-operation as practised in 1915–16. The Lysander was in no sense a combat aircraft. In addition there would be No. 1 Group of Bomber Command, consisting of the Fairey Battles that were unsuitable for any other purpose, and also No. 2 Group, the Blenheims, but these would stay in England and remain within the Command. These bombers were designated the Advanced Air Striking Force, and were really seen as an outpost of Bomber Command itself. They could lend support to the BEF's Air Component, the Lysanders, but for either purpose they would require to have fighter backing.

Dowding had little doubt about what this would have to consist of. The only RAF aircraft that could deal with the modern German

fighters – in particular the Messerschmitt Bf 109s whose performance had been noted in Spain – were his precious Hurricanes and Spitfires. The Spitfires he was determined not to let out of his grasp, so it would have to be Hurricanes – at first just four squadrons of them. But the demand for fighters from all quarters grew, and Dowding grimly remarked: 'the despatch of 4 Field Force squadrons has opened a tap through which will run the total Hurricane production'. This was an alarming thought, and Dowding's struggle to preserve adequate strength in his Command for its overriding task of Home Defence was what brought him into bitter conflict with the Air Staff. And there was scarcely anything the Air Staff could do, caught between Dowding's legitimate protests, and the equally legitimate demands of the Army for protection and aid which only the RAF could give.

It is now quite clear that in 1939 Britain was atoning for what have well been called 'locust years' – the years of economy, disarmament, internationalism, pacifism, anything, in fact, except military preparation in the face of open and clearly identifiable threats. The RAF had to make additional atonement for its attachment to fallacious doctrines. Once in the war, however, some fundamental reappraisals occurred very quickly. First, there was the immediate abandonment of a strategic air offensive of which I have spoken. Coupled with that was the disconcerting early discovery that, as far as the German mainland was concerned, daylight operations were out of the question; whatever was to be done would have to be done at night. In other words, Bomber Command would have to become a night force, which was something for which it had never been intended, equipped or trained. This was fundamental indeed. It was also realised with dismay that even in attacking the more accessible targets, just across the North Sea, bombers were not able to defend themselves in daylight against modern fighters, even if they held tight formation. Slowly and very reluctantly a few – but only a few – of the RAF's leaders began to see the necessity of revising another piece of firmly held doctrine – that bombers should operate without fighter escorts. This was going to be an issue absolutely fundamental to the air war.

When the real fighting in the West began, in 1940, the lessons flowed in thick and fast. The campaign in Norway displayed in full view what should never have been in any doubt – the incalculable advantage that air power confers in operations in a large country with poor communications, and the fatal disad-

vantage of not having it. One reads with amazement of the decision to send an Allied expeditionary force to Norway without an air component; I said in *The Right of the Line*: 'It was as though Poland had never been, Spain had never been, the great air operations of 1918 had never been . . .' And the further lesson, of course, was the value of air transport, which the Germans used lavishly – the Junkers 52s – and which the RAF always lacked, certainly until 1943.

It was, however, the Battle of France in May and June 1940 that supplied the real tutorial. It is difficult, in my opinion, to exaggerate the historical importance of the Battle of France; it was what one distinguished British historian has called 'the pay-off' – the pay-off of a whole complex of errors, political, ideological, technological and strategic, which possessed the Western world between the wars.

The German triumph in France in 1940 has been attributed to various factors with more or less of truth; to sheer numbers, which is wrong; to numbers of tanks, which is also wrong – it was not the German numbers, but the German system, that won the tank battles: to dive-bombers – the famous Ju 87s – which is occasionally right, but not generally so; to numbers of aircraft – which is nearer the mark, but we need to be clear about what kind of aircraft. And, of course, there was the factor of morale, which played a very large part – the low morale of the French Army compared with the high morale of the German – and it is important to identify the element which chiefly affected morale. Surely it was air power?

For myself, I have no hesitation in saying that the decisive factor in May 1940 was what I call 'the saturation of a battle area by air power' – and at the root of that achievement was the fighter. In France, in 1940, the fighter was the sanction of all that occurred or did not occur. The German movements were hidden from Allied eyes by a canopy of fighters which the Allies could not penetrate; the most significant example of this was the advance through the Ardennes defiles, when the German armour presented superb targets, which however the Allies were never able to attack.

When the German offensive unfolded, the call for more and more fighters was loud and constant. It came not only from the BEF, but from the French too, their own air force being virtually overwhelmed from the beginning by the German fighters. It would, in fact, be scarcely too much to say that the only weapon on the Allied side which proved to be steadily able to cope with

the stresses of this battle was the Hawker Hurricane. In the event, the equivalent of 16 Hurricane squadrons took part, but this had a disruptive effect on more Fighter Command units than that, because of the mistaken Air Staff policy of sending over half-squadrons. This equivalent of 16 squadrons in May and June is to be compared with 25 Hurricane-equipped squadrons which would be available for the Battle of Britain in July; it represents over 60 per cent of the Hurricane force.

The RAF's inability to wage this kind of war effectively was pathetically obvious. The Fairey Battles of the AASF were shot out of the sky; Blenheims from No. 2 Group suffered the same fate on certain occasions; as regards the rest of Bomber Command, all it could offer was night attacks on German oil refineries and railways, in the hope of cutting off the fuel supplies of the Panzer divisions. Such long-range intervention would be cold comfort indeed to men actually locked in battle with those Panzer divisions. What it all meant was, as I said in my book, that the RAF found itself in the position of 'looking over both shoulders at once, which is an awkward posture for a man and tends to blur his vision'. The Air Staff and Bomber Command were looking at Germany; Dowding was looking at Britain, which it was his duty to defend. But the decisive battle was happening in France, and the hard truth is that the RAF was almost irrelevant to it. The lesson of that is clear.

In 1940 the Allies discovered that their weapons and their system of war were irrelevant to the 1,200 German fighters which had saturated the battle area and made possible the operations of about 1,700 bombers and 10 Panzer divisions. The Maginot Line, the small, ill-prepared British Expeditionary Force, the advance into Belgium, Bomber Command's desire to bomb Germany – all were irrelevant to the power of the German fighters over the battlefield. That was one lesson of 1940; another, which had to be expensively re-learned, was that land and air operations are, after all, intimately connected. When the enemy attacks in strength, Air Force units in his path are in as much danger as the army; if he breaks the front, they will have to run for their lives as fast as anyone else. So keeping the land enemy at bay is as much a matter of air security as of ground security.

The Battle of France, a humiliating disaster for the Western Allies, is one of history's great punctuation-marks. It totally altered the terms of reference of the Second World War. It marked the end of an epoch – an epoch of dreams, unreality,

theories and follies. It was a breath of brutal reality, brushing aside the deceptive fogs of preconceived ideas. But for the even greater and still barely intelligible folly of Adolf Hitler, it could all too easily have marked the end of Britain.

In one respect, however, the dreams did not quite end, and it is difficult – as matters turned out – to exaggerate the importance of that fact. In 1940 Britain did not sue for peace; she rejected any notion of compromise with Hitler, even in abject defeat. Yet, as the late Sir Basil Liddell Hart has bluntly said, 'The course of no compromise was equivalent to slow suicide.'¹³ And he continues: 'But the British people took little account of the hard facts of their situation. They were instinctively stubborn and strategically ignorant. . . . Never was their collective characterization as a bulldog so clearly demonstrated, and justified, in all its sublime stupidity.' It is not often that I find myself in agreement with Liddell Hart, but with this judgement I agree entirely. Yet what happened seemed – against all the odds – to give complete justification to the strategic ignorance and the stupidity, sublime or otherwise. With Norway and Denmark occupied, Holland, Belgium and France under his heel, it only remained for Hitler to invade the now virtually disarmed British Isles, and total victory would be his.

The German problem was how to mount an invasion of the helpless island in the face of the practically intact Royal Navy. Certainly the German Navy, after its heavy losses in the Norwegian campaign, was in no condition to try to seize command of the Channel. Could the German Air Force do the trick? So far the Luftwaffe had triumphed in everything it had undertaken, building a fearsome reputation in the process. Could it now take command of the sky over the narrow waters of the natural invasion front effectively enough to neutralise sea-power? Hermann Goering, its commander, said it could, and Hitler allowed himself to be persuaded. There followed the Battle of Britain, the first decisive air battle in history, decisive in all senses of the word.

It was also an event full of irony. It was a battle almost entirely fought and won by the RAF's Fighter Command; if there had been no separate RAF, it is difficult to see how there could have been a Fighter Command; yet the separate RAF really existed for a quite different purpose – offensive bombing; the RAF was not about fighters at all.

In the Battle of Britain, as is usual in air matters, we see technology at the centre of the event. There were, first, the two

admirable aircraft, the Supermarine Spitfire and the Hawker Hurricane, Britain's two best weapons. And this time there was also a system of war matching the needs of the occasion. It could indeed be said that this battle was already being won three years before it happened, because what finally won it, what put the crown upon all the skill and courage of the pilots, was the system of air defence based on early radar warnings that Sir Hugh Dowding had been building up from the very beginnings of Fighter Command in 1936.

The Dowding battle system was founded on tight control of the fighter force, and on deployment based on the information coming from the radar chain (backed by the Observer Corps and other sources) received in Fighter Command's central Operations Room, then filtered and transmitted outwards to the Operations Rooms of the Groups and sectors and finally the squadrons, in the form of precise orders, through one of the most comprehensive communications networks ever seen to that date. The essence of the system was control, all the way down; in the course of the Battle Air Vice-Marshal Sir Keith Park, commanding No. 11 Group which defended south-eastern England, issued no fewer than 35 Instructions regulating the manner in which it was to be fought.

It is evident that there was no place in such a system as this for 'mavericks', for 'free-lance' activities – yet these can never be ruled out, and their intrusion provides the only serious blemish in Fighter Command's achievement. Air Vice-Marshal Sir Trafford Leigh-Mallory of No. 12 Group, stationed further north, vociferously backed by Squadron-Leader Douglas Bader, the legless commander of No. 242 Squadron, contested the way that Dowding was fighting the battle, urging greater participation by No. 12 Group and the use of a 'big wing' or 'balbo' – three, four or five squadrons (some 60 aircraft) operating together in mass. With this they promised to inflict such crippling losses on the attackers that they would not return. There was never any great amount of tactical reality in this proposal; Fighter Command's limited resources required to be allocated with economy and precision. Leigh-Mallory and Bader also lost sight of the truth expressed by the Official Historian Group-Captain T. P. Gleave: 'The prime purpose of a fighter defence is to prevent the enemy bombers reaching their targets.'¹⁴ Regrettably, one concludes that this whole unpleasant quarrel was a matter of personality (which features as powerfully in air warfare as in any other) – the ambitious personality of Leigh-Mallory and the eager, com-

bative personality of Bader. The blemish lies in the apparent inability of RAF command procedures to deal with a situation which ought never to have developed.

The RAF's achievement in the Battle of Britain (we should remember that both Bomber Command and Coastal Command also played a part in it) was victory, clear and unmistakable; the clear defeat of the Luftwaffe, Germany's first defeat in the Second World War. It is important to see clearly in what that achievement consisted; there has persisted a tendency to define it purely by reckoning losses – what I have called 'the numbers game', by which I mean acceptance of exaggerated claims of enemy aircraft destroyed.

All air forces are prone to this; in 1940 the Luftwaffe to all intents and purposes wiped out Fighter Command several times over; we saw the same mistake being made in the Falklands air fighting in 1982. It is a natural error, comforting to the airmen who commit it, and to the anxious civilians behind them. Five times, during the Battle of Britain, the Air Ministry claimed over 100 German aircraft destroyed in one day:

August 15: 180 – the true figure was 76;

August 18: 153 – actually 67;

September 7: 103 – actually 41;

September 15: 185 – actually 61; and

September 27: 133 – actually 57.

The truth is that on no occasion did the Germans lose as many as 100 aircraft on one day; on only four occasions did they lose more than 50. But what they did lose was enough to decide the issue.

From that decision Air Chief Marshal Sir Hugh Dowding emerges as the only air commander with an unquestionable 'battle honour' of his own. Strangely and sadly, the RAF and successive governments found sufficient reasons for not making him a Marshal of the Royal Air Force (its highest rank). Yet it was under him that, beyond any reasonable dispute, the Royal Air Force took up its position 'on the right of the line' in that war, giving the first justification of the title of my book. As the war went on, other Commands moved to the right of the line as Fighter Command had done in 1940. But we may note that it was Fighter Command's exploit in that year that provided the one solid justification of the RAF's functional Command system which, in other respects, proved to have serious drawbacks.

When Fighter Command won the air battle, invasion of Britain

was ruled out (and one senses Hitler's misguided relief at that). Yet by any rational military judgement Britain's overall position remained hopeless. Her very survival was precarious, and without a powerful ally her real ability to defeat Germany (now the world's greatest land power) was precisely nil. By great good fortune, however, rational military judgement did not decide the issue; Hitler took the astonishing and lunatic course of attacking the Soviet Union while Britain remained undefeated at his back. So Britain was saved by the folly of her enemies: but it cannot by any means be called wise policy to count on such a contingency.

When I say that 'survival was precarious' even after the air victory, I mean that for those at the centre of affairs another and equally serious threat was visibly developing by the end of 1940. This was the submarine campaign directed against Britain's entire supply system, military and civilian; it took on a new and very alarming dimension when the German armies occupied the whole Atlantic littoral from the North Cape to the Spanish frontier. As the Air Historical Branch Narrative, *The Royal Air Force in the Maritime War*, says, 'Never before in her history had Great Britain found herself faced by enemy forces on all sides except the West, a loophole which the German Navy attempted to close and thus isolate [her] from the rest of the world.'¹⁵

It was, clearly, upon the Royal Navy that the main burden of countering this threat would fall, and in its entry upon this task we see once more the evil effect of supposition that the teaching of the First World War could safely be neglected.

In 1918 the maritime element of the RAF had no fewer than 37 squadrons, containing 285 flying boats and seaplanes and 272 landplanes, together with the entire dirigible fleet (103 airships), engaged upon anti-submarine duties. The air role had been thoroughly studied and precise rules formulated for the use of aircraft in convoy protection. The deterrent effect of aircraft on submarines, even the relatively feeble aircraft of 1914-18, was well understood.

In 1939 the maritime RAF was Coastal Command, then under acting Air Chief Marshal Sir Frederick Bowhill, an ex-sailor. Coastal Command was the 'Cinderella' of the Commands, a condition perfectly illustrated by its equipment; the core of its strength was 10 squadrons of Avro Ansons, twin-engined machines designed in 1933 which were scarcely military aircraft at all, lacking speed, lacking range and virtually unarmed. In fact Coastal Command as a whole had practically no combat ca-

capacity, and no role could be found for it, either by the Air Ministry or the Admiralty, other than reconnaissance in the North Sea. The well-developed anti-submarine role of 1918 had been completely lost to view.

The Admiralty has to bear a large portion of the blame for this; amazingly, we find the Naval Staff asserting in 1937 that 'the submarine should never again be able to present us with the problem we faced in 1917'.¹⁶ The Royal Navy entered the Second World War placing its whole reliance on ASDIC—the sonar device invented in 1917 and introduced in 1918, but too late to be operationally effective. ASDIC had been enormously improved between the wars (hence that astonishing confidence that the submarine threat had been overcome). I say 'astonishing' because it was a simple technical fact that ASDIC was unable to locate a submarine on the surface, and in 1918 37 per cent of U-boat attacks in British home waters and 67 per cent of those in the Mediterranean had been made on the surface at night—a tactic no less difficult to deal with in 1940–1 than in the previous war.

The Royal Navy had also forgotten the hard-bought lesson of 1917–18 that what it liked to call 'offensive tactics' (large-scale anti-U-boat hunting operations) were a sheer waste of time. The one sure place to find U-boats was close to merchant shipping, and convoy escort, still derided as 'defensive' action in the Second World War, was in fact the opposite; that was where U-boat kills were chiefly to be made. And for convoy escort 1918 had also taught that the right kind of aircraft were essential.

From 1939 right up to 1943 Coastal Command's great struggle was for the necessary equipment of all kinds; for better aircraft, especially Very Long Range (particularly the VLR B-24 Liberators); for weapons—bombs and depth-charges with the right fuses and fillings; for air-to-surface-vessel (ASV) radar, in fierce competition with Bomber Command; and always there was the struggle for sheer numbers with which to carry out a multiplicity of tasks, of which anti-submarine warfare was only one, though undoubtedly the most important. And all the time there was the intense tactical study, the ceaseless perfection of techniques; methods of attack, speeds, heights and angles of approach, fuse settings, depth-charge spacings, communications with naval vessels and ships in convoy, etc., etc.

The Battle of the Atlantic began effectively when the Germans reached the Atlantic shore, and for the next three years, as Churchill said, that 'one anxiety reigned supreme'.¹⁷ It was

always a highly complicated battle, and the dominating figure in it was Admiral Karl Doenitz. I see in him resemblances to two of the RAF's major commanders; a resemblance to Dowding, because both operated by a tightly controlled system made possible by modern communications technology; and a resemblance to Air Chief Marshal Harris, because both believed that they possessed a war-winning weapon (the U-boat and the Lancaster bomber), Doenitz, I think, with greater justification.

By 1942 British anti-submarine warfare had relearned the forgotten lessons of 1917-18, especially the lesson of inter-Service co-operation. At last the day came (in July of that year) when air action, which in the first half of the year had accounted for just over 30 per cent of a very small number of U-boat kills, in the second half accounted for nearly 50 per cent of a substantial number. Coastal Command's share was 20.7 per cent of the air total, which was not brilliant in itself, but it meant that the Command was at last firmly 'in the game'. It was a turning point in the battle.

The moment of decision in the Atlantic was May 1943, during which no fewer than 41 U-boats were sunk, and Doenitz admitted defeat. Aircraft claimed 56 per cent of these kills, and of the aircraft total Coastal Command claimed 69.5 per cent. Of all the forces engaged, British and American, it had become the chief U-boat killer - a long way indeed from the pathetic condition of 1939.

'D-Day' in 1944 put the crown on Coastal Command's efforts, as it did on the Atlantic battle as a whole. Thirty Coastal Command squadrons covered the south-western approaches to the D-Day convoy routes, quartering every square mile of sea every thirty minutes by day and by night, with the result that the U-boats proved totally ineffective against the great Allied combined operation. That operation was the lynch-pin of Anglo-American offensive strategy in the war; from the moment that it had been agreed, as I wrote: '... whatever contributed to this end would promote the prime intention; whatever impeded it would be, to a greater or lesser extent, harmful.'¹⁸ The D-Day landings and the Battle of Normandy were the supreme offensive action of the Western Allies in the war, their great contribution to the defeat of Germany. The victory in the West could not have taken place without the victory in the Atlantic, which thus rates not merely as a *defensive* victory ensuring Britain's survival, but also as an *offensive* victory of the profoundest importance. I claim that by virtue of its contribution to this, Coastal

Command in its turn had advanced to the right of the line.

We have been looking ahead; now we must return to 1940 and the 'punctuation-mark' in history of which I spoke earlier. Britain had won one fight for survival and was firmly locked in another; what else was she doing towards actually defeating Germany? What *could* she do? The answer to both questions is, I fear, 'not much'.

The Royal Navy was deeply absorbed in the Atlantic battle (which, for a time, we must remember, included the actions of the powerful vessels of the German surface fleet as well as the U-boats). The Navy was also under severe strain in the Mediterranean, coping with U-boats, the Luftwaffe and the Italian Navy; and when Japan came into the war the Admiralty, echoing 1917, stated that 'we had lost a measure of control over the sea communications of the world', and frankly admitted that 'ships alone were unable to maintain command at sea'.¹⁹ In any case, the Royal Navy could not be the direct element in winning victory over a major land power based in central Europe.

What of the Army? General Sir David Fraser has recently pointed out that from 1940 until 1942 only four formed British divisions were in actual contact with the German Army – the main enemy. It is also a fact that with the exception of the brief disastrous campaign in Greece, from June 1940 until November 1942 the British Army never encountered more than four weak German divisions, the Afrika Korps, out of an order of battle of over 170 German divisions.

So the question arises, was there *anything* at all that Britain could do about engaging her main enemy in 1941 and 1942? The answer was clear: yes, she could use Bomber Command to attack communications, military installations and war industry in the Reich. And Bomber Command could also strike at German morale – a subject to which I shall return. This might not be the 'knock-out blow' of pre-war dreams, but it was better than nothing. And so, with a force which until 1943 was almost entirely composed of Wellingtons, Hampdens and Whitleys, and very rarely in 1941 numbered more than some 200 operational aircraft, Bomber Command set out to do just that, because there was *absolutely nothing else that Britain could do*.

Bomber Command thus shared the grim experience of the British Expeditionary Force in 1915 and 1916, lacking weapons, lacking necessary equipment of all kinds, lacking experience and training, but forced by inexorable circumstances to engage a powerful and determined enemy. War has an unpleasant habit

of producing inexorable circumstances; the misfortunes of the 1915-17 BEF were due to the disciplines of a coalition war, of fighting beside an ally; the misfortunes of Bomber Command between 1940 and 1943 were due to the discipline of not having one. The two inexorabilities underline 'the grim truth that whether inside or outside an alliance, there is no substitute for strength.'²⁰ The strategic air offensive, as it developed between 1940 and 1945, was born of weakness.

Without utter defeat in France, if the front in the West had continued to exist as it did between 1914 and 1918, it is difficult to see how there could have been a strategic air offensive as we know it; the RAF's resources would have been far too stretched, the demands on it too imperative.

Thus Bomber Command also came to the right of the line, to find it an exceedingly uncomfortable place. It would, of course, have been out of the question to tell all those eager, optimistic young men that their task was an impossible one, but that they must stick to it until they were shot down because there was nothing else for it – just as it would have been out of the question to tell the 1915-16 infantry that they had no hope of any worthwhile success, but they must go 'over the top' and get killed just the same. Soldiers must have some hope, something to cling to even in weakness and defeat – the illusion of a possible victory. And it is an inevitable risk that in building illusions of victory the commanders may succumb to them themselves.

Some of the statements of possibility and intent put forward by the Chief of the Air Staff, Sir Charles Portal, in 1941 and 1942 are breathtaking in what I called their 'cocksureness', reflecting the persistence of the old 'knock-out blow' illusion. The British bomber offensive is always associated – understandably – with Bomber Command's most famous AOC, Air Chief Marshal Sir Arthur Harris. It was not his brain-child, nor was it his sole responsibility. It was not even the sole responsibility of the Air Staff itself. It was the responsibility of the Chiefs of Staff Committee and later the Combined (British and American) Chiefs of Staff and of the British and American Governments, with, let it be said, the warm approval of the overwhelming majority of their peoples.

It was the form of the strategic air offensive that aroused dismay (a little even at the time, a great deal later). That form was dictated simply by technology and technique. Above all, it was dictated by the embarrassing, baffling, but inescapable

discovery in 1941 that the only target that Bomber Command could be trusted to hit by night was a large town. At that stage of bombing technology, in other words, its only reliable technique was area bombing, a name that would gather evil associations.

Area bombing had the attraction that it offered at least a chance of hitting some sort of military target – some factory, power station, oil plant, or whatever it might be, of direct value to the German war effort – and at the same time a chance of striking at German morale, which Bomber Command and the Air Staff, inspired by Lord Trenchard, believed to be the weak spot in Germany's armour. As I said in my book, there is no point in being mealy-mouthed about the attack on morale: "Morale" is a cosmetic word. Attacking morale, whatever phrases it may be dressed up in, really means only one thing; putting the fear of death into individuals. On a collective scale, it means threatening a massacre.²¹

The scale of the proposed massacre is breathtaking indeed. In November 1942, Air Chief Marshal Portal put up to the Chiefs of Staff the proposition that it would be possible in 1943 and 1944 to drop 1.75 million tons (nearly 12.75 million kg) of bombs on Germany. He outlined the material damage that could be expected from this, and then stated that: 'Twenty-five million Germans would be rendered homeless, 900,000 would be killed and one million seriously injured.'²² 'One thing,' I said, 'emerges with absolute clarity; this was a prescription for massacre, nothing more nor less.'²³

It was certainly a very long way from the pious intentions of the 1930s, and the pious hopes of avoiding bloodbaths with which Britain had gone to war in 1939.

Hindsight can be a trap; we have to remember that this proposal was made in November 1942, near the close of a very bad year, littered with Allied disasters; none of the hopeful things that happened in 1943 had yet appeared; the war was still dominated by Nazi power, and as Dr Noble Frankland insisted: 'The great immorality open to us in 1940 and 1941 was to lose the war against Hitler's Germany. To have abandoned the only means of direct attack which we had at our disposal would have been a long step in that direction.' One thing, I believe, is as certain as anything in human history can be: that some form of bombing offensive by the RAF was inevitable between 1940 and 1943, and was also essential if Britain's continued participation in the war was to have credibility in the eyes of the British

people, in the eyes of the Germans, and in the eyes of Britain's new allies.

It is also my belief, however, that morale, so far from being Germany's weak spot, was a very poor target to select for attack. Once more, a bad misreading of the First World War was having a serious effect. The British, virtually from top to bottom of the nation, in their horrified recoil from the heavy losses suffered between 1914 and 1918, had been taught and had come to believe that these were due to the idiocy of their own generals. This obscured the truth: the British losses were due to the German Army, whose main body the BEF engaged for three hard years. This was an army of which one British Official Historian, Captain Cyril Falls, wrote: 'The commanders who had such troops to rely on in days of adversity were fortunate. It was almost impossible to ask or expect of them more than they were ready to give and capable of giving.'²⁴ The German Army mostly maintained its morale to the very end under fearful pressures. And it was a conscript army, which means that it reflected the character of the people from whom it sprang. The same was true of its successor between 1940 and 1945; the morale of German civilians, like the morale of the German Army, remained steadfast to a point beyond all belief.

There is another aspect of the bombing offensive which grates upon me. Both the Air Staff and successive AOCs-in-C of Bomber Command – but none more vociferously than Sir Arthur Harris – complained constantly of what they called 'diversions' of the Command to what they seem truly to have considered fringe activities. I made a list of the chief 'diversions' that the bomber commanders so strongly objected to, and concluded that they could be summed up very succinctly as 'the war itself'. Indeed, I felt compelled to remark that 'It is at times difficult, taking into account the ineffectiveness of Bomber Command's "proper" activity, and its strong resistance to all improper activity, to decide whether it is more correct to say that Bomber Command was irrelevant to the war, or the war was irrelevant to Bomber Command.'²⁵ We have already observed the undesirability of being irrelevant.

The war took its revenge; Bomber Command's greatest battle was the so-called Battle of Berlin, which lasted from November 1943 until March 1944. This was intended to be Harris's 'knock-out blow'; he told Churchill: 'It will cost us between 400 and 500 aircraft. It will cost Germany the war.'²⁶ The task was to be completed by 1 April – thus making Operation Overlord un-

necessary. But it did not work out that way; instead, the Battle of Berlin proved to be a costly defeat for Bomber Command, with 1,047 aircraft missing (over 7,000 aircrew) and another 1,682 damaged. Berlin was not destroyed, though it was badly damaged; life went on, and German war industry now began to reach amazing peaks of production.

Yet within this period there was a brilliant gleam of light for the Allies. The chief agent of Bomber Command's defeat had been the German fighter force, which also in 1943 inflicted severe defeat on the United States 8th Army Air Force, operating in daylight. In early 1944 this situation was reversed. This was a dramatic turn, due almost entirely to the North American P-51B long-range fighter, the Mustang, a weapon which the British Air Staff had pronounced to be impossible, but which the 8th Air Force now used with deadly effect to destroy the German fighter force both as a daylight and as night instrument. This spelt the triumph of the Allied bombers, demonstrating that air warfare was not revolutionary, but subject to the same disciplines as other forms; it, too, required the defeat of the opposing enemy forces in order to be effective. And thus it came about that in 1944 and 1945 Bomber Command became relevant to the war in a manner that gave general satisfaction, and even surprised itself and its redoubtable AOC-in-C; precision bombing of oil plants, bridges, viaducts, canals and railways, with immediate and disastrous military effects.

And now finally I come to a very different matter, a contrasting and highly effective style of air warfare which its most distinguished practitioner called 'air warfare in its own right'. The officer in question was Air Chief Marshal Sir Arthur Tedder, who emerges, to me, as the outstanding British airman of the war, with the largest view of its conduct. This is not to be wondered at; Tedder became AOC-in-C, Middle East, in May 1941, and this was a command with a difference. Utterly unlike the functional Commands of the RAF in Britain, Middle East Command was itself *an air force*. It contained something of everything, because it had a need and a use for everything. Naturally, Tedder's view was therefore different from, and generally broader than, that of any of the Home Command AOCs, able though most of them were.

He expressed his understanding of the war very soon after taking up his post, in a letter to Admiral Sir Andrew Cunningham, the Commander-in-Chief of the Mediterranean Fleet, with whom he was having a lively dispute about naval air support;

Tedder said: 'In my opinion, sea, land and air operations in the Middle East Theatre are now so closely inter-related that effective coordination will only be possible if the campaign is considered and controlled as a *combined operation in the full sense of that term*,'²⁷ (my italics).

This was a view from which Tedder did not depart; he is on record in 1944 saying: 'I do not myself believe that any modern war can be won either at sea or on the land alone or in the air alone. . . . In other words, war has changed to three-dimensional, and very few people realize that.'²⁸ This analysis was diametrically opposite to the Trenchard doctrine on which the RAF had been reared, and equally opposite to the Harris view and, indeed, the Portal view. It put Tedder into a very rare class, and even today I am not altogether sure how far the message has sunk in.

His interpretation of the war soon drew Tedder towards another realisation which was of the greatest importance; this crystallised in the dark days of 1942, when disaster was a very present probability for the British forces in the Middle East. I expressed it in these words:

Once again, the war was driving home the lesson that when critical land operations are in progress, army cooperation is not simply the specialized activity of part of an air force. It is the function of the entire force, with all its available strength. Recognition of this was the most important contribution of the Middle East campaigns and from that recognition it is impossible to separate the name of Tedder.²⁹

Operation Overlord in 1944 illustrates this perfectly. I have already referred to the part played in it by Coastal Command; Bomber Command and the United States Strategic Air Forces took on a variety of roles, of which the Interdiction programme – the isolation of the whole Normandy battle area – was the most important; the Air Defence of Great Britain (the unglamorous new name for Fighter Command) was also deeply involved; and the Tactical Air Forces, a name and concept formally dating from January 1943 in North Africa, 'saturated the battlefield with air power' as the Germans themselves had done in 1940. Tedder's two perceptions, that the war was, from the Allied point of view, a combined operation, and that the combination might well require the entire available air strength, were thus fully confirmed.

Tedder added yet another, of the same quality; from Decem-

ber 1941 onwards, the war in the West was a coalition war again, subject to all the disciplines of such. They are a severe test of the true carat of commanders. In 1944 Tedder became Deputy to the Supreme Allied Commander, General Eisenhower, who had already shown himself to be an outstanding coalition leader. He and Tedder proved to be of like mind; I wrote, in summary: 'Broad vision, long sight, complete professionalism - such were the ingredients of Tedder's undoubted greatness.'³⁰ Under Tedder and his able subordinate, Air Marshal Sir Arthur Coningham, the neglected art of army co-operation was revived under the stresses of battle in the desert in 1941 and 1942. In conjunction with the valuable experimental work of Army Co-operation Command in England, it evolved by 1943 into a fairly exact science. As such, army co-operation (which the RAF called 'Air Support') was a prominent feature of all the combined operations of the war - the desert campaigns in Egypt and Libya; the campaigns in Tunisia, in Sicily, in Italy; and Overlord itself.

Histories of Overlord, for understandable reasons, tend to dwell too much on 'D-Day' and the landings on the beaches of Normandy. I believe we should think more about what made 'D-Day' possible, and it is difficult to call to mind anything more important in that respect than the 9-week campaign conducted by the Allied Air Forces before any soldiers or sailors even approached the Normandy coast in June 1944. I refer to the fact that during that period the Air Forces (excluding Coastal Command) flew 195,200 sorties in preparation for Overlord, of which the RAF share was 71,800, and in which a total of 1,953 aircraft were lost (1,251 American), and more than 12,000 officers and other ranks were casualties, mostly killed.

From 'D-Day' itself until the end of the war, the Tactical Air Forces gave invaluable support to the armies; very few indeed were the days, in a bad summer, when they did not fly. In August, when the Germans made their last counter-attack in Normandy at Mortain, in Coningham's proud words, the Tactical Air Forces 'made air history'. The Panzer attack was smashed, and it was, he said, 'proved that a Tactical Air Force may be a decisive battle-winning factor'.³¹

Shortly afterwards, in the Falaise Gap, as the Germans tried to extricate the remains of their forces, the Tactical Air Forces fell upon them again, and 'The image of the utter destruction of men and machines that they caused on the ground with rockets, cannon and bombs, is one of the most familiar pictures of the air war'.³²

In the full three months of the Battle of Normandy, the four RAF Commands concerned flew 224,889 sorties, and the RAF lost 2,036 aircraft and 8,178 aircrew. What they had achieved was an outstanding triumph of air power: 'It was air power that paved the way into Europe; air power covered the landings and made it impossible for the Germans to concentrate against them; air power maintained interdiction, and pressure on the enemy when the "master plan" failed; air power completed the overwhelming victory.'³³ I have never had any occasion to doubt or regret my verdict that, as far as Britain was concerned in the Second World War, the Royal Air Force held the Right of the Line.

Notes

1. Walter Raleigh and H. A. Jones, *The War in the Air*, Oxford, 1922-37, Vol. i, p. 285.
2. Sir Maurice Dean, *The Royal Air Force and Two World Wars*, London, 1979, p. 151.
3. Field-Marshal Sir William Robertson, *Soldiers and Statesmen 1914-1918*, London, 1926, Vol. ii, p. 17, Robertson to Field-Marshal Sir Douglas Haig, 9 July 1917.
4. Lieutenant-Colonel C. à Court Repington, *The First World War 1914-1918*, London, 1920, Vol. ii, pp. 160-1, diary entry 23 to 30 Dec. 1917.
5. H. A. Jones, in Raleigh and Jones, *The War in the Air*, Vol. vi, pp. 135-6.
6. Quoted in Dean, *RAF*, p. 59.
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30. *Ibid.*, p. 686.
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24

Commentary

Karl Gundelach

The glorious role played by the US and the British air forces in the Second World War and their influence on the outcome of the war led to the widespread conviction that these air forces had excelled from the outset in every respect. The merit of the chapters by John Terraine and Lee Kennett lies in the illustration of the real shortcomings in a decisive sector of the air war, namely the contribution of tactical air operations to the total effort.

I do not have to comment on the details described by Lee Kennett; I merely wish to point out the contradictory situations in which the US air forces found themselves in late 1942. At that time there were in fact two air forces: when in the winter of 1942/3 the Americans encountered the Germans in the air over North Africa they suffered serious setbacks in *tactical air operations*; this will be discussed in more detail later on. On the other hand, their 8th Air Force had already shown her credentials in the first attack on Rouen, which was launched from England on 17 August 1942 and which marked the beginning of the US bomber offensive.

The reasons behind a similar neglect of tactical air operations by the RAF have been clearly illustrated by John Terraine. The Spanish Civil War did nothing to change this attitude. Although the British were aware of the contribution made by tactical air warfare carried out by the Condor Legion to Franco's success, the Chief of Air Staff, even as late as 1937, regarded this as a 'serious misuse of air power'. The RAF continued to rely on the long-range bomber strategy and, in 1936, established Bomber Command as the central command. However, they failed to provide the proper means of achieving their own objective of 'destroying' the enemy's war potential. In mid-1939 they were

completely unprepared for war – on 3 September 1939, there were only 204 twin-engine bombers.

The Second World War saw Britain caught up in another war on the Continent on the side of the French. The one thing they had wanted to avoid at all costs after 1918 became reality once again: another expeditionary force, with all its consequences. Its air arm comprised the RAF Component, and the tactical air force assigned to it was the more or less improvised 'Advanced Striking Force', with, according to Churchill, some 460 aircraft. Their crews fought a courageous battle, but they could not hold out for long against the Luftwaffe; the Fairey Battles and Blenheims met their Waterloo in the afternoon of 14 May 1940, when they lost a total of 48 aircraft out of the 99 present in the area around Sedan – mostly through operations of Me 109 units which had been moved close to the front. In the morning, the flak had already downed 37 French planes. The decisive factor in May and June 1940 was 'the saturation of the battlefield with air power', as John Terraine vividly describes it – and the outcome is no secret.

What could Britain do after this defeat? Initially, she repulsed the Luftwaffe assault on England in the Battle of Britain with her powerful Fighter Command, thus inflicting on it its first major defeat. There is no need to go into details here. But beyond that the only contribution the RAF could make to the fight against Nazi Germany was in the form of strategic bombing. John Terraine characterises the development of the bomber offensive between 1940 and 1945 as an offensive born out of weakness – an interesting aspect!

The defeat of May–June 1940 in France forced the RAF to turn more towards co-operation between the army and the air force. But there was not much time, since the spread of the war to North Africa, where Marshal Graziani had suffered a decisive defeat at Sidi Barrani on 9 December 1940 in the first clash of the British and the Italians, gave rise to the problem of air support for the British ground forces operating there.

But this defeat had led to the intervention of the German ally. Hitler sent Rommel to North Africa and redeployed the Air Corps to Sicily, with the Air Corps in turn detaching the *Fliegerführer Afrika*. His mission was 'to lead and employ the Luftwaffe flying units and flak operating in Africa in such a way as to provide the best possible support for the German Army units employed there.' Rommel's attempt to have the *Fliegerführer* placed under his operational control was frustrated by the

Luftwaffe, that is by Goering's jealous guarding of the independence of what he saw as 'his Luftwaffe', enjoying equal status with the army. So, business was conducted on the usual principle of 'co-operation', which did not prevent close co-operation but provided the Luftwaffe with the possibility of refusing to comply in such operational questions as were considered to be within her own domain of decision-making and which might jeopardise her units: the only forces of the *Fliegerführer Afrika* directly assigned to Rommel's operational control were one close reconnaissance squadron and several Flak detachments for short-range air defence.

In the ensuing period, there were some minor clashes with the impulsive Rommel, but the trustful co-operation worked so well with the help of air and army liaison officers and forward air-control points in the very first front line that the *Fliegerführer* could provide Rommel with tactical support, first in 1941 and then in 1942 in the capture of Tobruk and thereafter right up to El Alamein. On average, he had some 250-300 aircraft, basically a small-scale Luftwaffe, which included reconnaissance aircraft, fighters, fighter-bombers, twin-engine long-range fighters, night fighters, dive-bombers, and assault aircraft (i.e. bombers). In addition, he had Flak units for the protection of airfields and signal units to provide the necessary communication in all directions.

In the mean time the Royal Air Force had been given a similar structure. Air Chief Marshal Tedder, Commander of the Middle East Command, who was convinced that a campaign could only be won by a combined operation by the three services, had ensured that the opponent of the *Fliegerführer Afrika*, the 'Western Desert Air Force', was also equipped with all kinds of weapons. Its Commander, Air Marshal Coningham, had some 550 aircraft in October 1942, and had become a capable leader of tactical air units in the fight against the *Fliegerführer*. His idea was to begin by achieving air superiority, then to provide the army with indirect support (interdiction), and, finally, to provide close air support on the battlefield.

Thanks to his numerically superior forces, Coningham achieved air superiority over the battlefield at El Alamein, gave excellent support to the victorious forces of Montgomery and drove the *Fliegerführer* back to Tripoli.

These were the days of the Allied landing in North-west Africa and the opening of a second front in Tunisia. This created very serious difficulties for the US air forces operating in the area, in

their fight against the newly activated Fliegerkorps Tunis. These difficulties are attributable to the provisions of the US Field Manual (FM) 31-35 published in April 1942, which required the US air forces to adapt to the demands of the ground forces and the particular local situation. The manual stated that the primary target at any given time would normally be the one that posed the greatest threat to the supported ground forces. The final decision on the sequence of target engagement would be made by the commander of the supported unit.

Thus both the command structure and the doctrine of the US air forces were very much different from those developed by the RAF with Montgomery's 8th Army against the Fliegerführer Afrika and Rommel's Afrika Korps. There are enough examples of the serious setbacks suffered by the American system in 1942-3 in the Tunisian campaign against the Fliegerkorps Tunis (tactical air corps).

These failures called for a different organisation if the best use was to be made of the force. Air Marshal Coningham came to the aid of the US air forces and, in the face of opposition from army commanders used to controlling the missions of the tactical air forces, explained his views on offensive tactical air operations to them.

The new concept and principles were laid down in FM 100-20 ('Command and Employment of Air Force'), which came into effect in July 1943. The tactical air forces were now going after the air enemy both in the air and on the airfields, reaching far behind the front to attack further targets (interdiction) on the ground. Planning became a joint task of the Allied air force and army commanders throughout the entire theatre of war.

According to these principles – and with greatly expanded forces – the Allied forces, superior both in quantity and in quality, conducted tactical air operations in Italy, during the invasion of Western Europe and during the advance through France and Germany in 1945: the second level of strategic air operations, which made a significant contribution to the preparation and victorious execution of the land battle, in – to quote just a few examples – such operations as the invasion of Sicily, Salerno, Anzio-Nettuno and Operation Overlord.

The above discussion has shown that the great naval powers, the USA and Britain, accepted the idea of tactical air operations at a late date, but – from their point of view – not too late, and turned it into practical application of air power. Whereas this delay can be blamed on political, geostrategic and military

reasons, on the other hand it is important to examine how the continental powers France and Germany approached and solved these problems, since both remembered the head-on clash in the First World War and the trench warfare. However, from this starting-point they arrived at completely different solutions.

There can be no useful critical discussion of German air war doctrine without a tribute to the LDv 16 (Luftwaffe Manual 16) on the 'Conduct of the Air War' – Michel Forget has shown that conclusively and comprehensively in his chapter. First, although the manual stresses the independence of the Luftwaffe as a third branch of service alongside the army and the navy, it does not overemphasise this, but states that the Luftwaffe should 'always feel it belongs to the Wehrmacht and be conscious of the part played by the services in the fight'.

LDv 16 lays down three tasks for the Luftwaffe and lists them in order of priority:

- operations against enemy air forces;
- co-operation with the Army and the Navy, and engagement in land and naval operations; and, finally
- operations against the sources of strength of the enemy armed forces and disruption of the flow of the enemy's resources to the front.

I should point out that this is a highly characteristic order of priorities, because how much German military tradition and how much consideration of the geographical situation of a land power lie in the fact that – as opposed to Douhet's theories – co-operation with the other services of the Wehrmacht ranked second, and above strategic air operations proper.

The first task runs very much like a thread throughout the manual: destruction of the enemy air force, which is to be 'engaged right from the start of the war'. The principal target was the enemy's offensive aircraft (bombers), that is, his offensive capability. 'Destruction of the mobile units is to be a top priority.'

The second task of the Luftwaffe, co-operation with the army and the Navy, referred *only* to operations carried out by the Luftwaffe as an autonomous third service, and not to joint tactical operations carried out by the Luftwaffe in conjunction with the other two services. Support of the army by the autonomous, or 'operational' Luftwaffe, as it was known, was based on clearly defined categories: indirect support has definite

priority over direct intervention in ground operations. In LDv 16, interdiction was only possible using assault aircraft, preferably operating against long-range targets, because their destruction or elimination could have a decisive influence on army operations; whereas if they co-operate closely with the army they often do not find those targets against which their offensive capability can be exploited to the full.

The third task described by LDv 16 is the fight against the enemy's 'sources of strength'. It hits the enemy right at the heart of his will to fight and to resist.'

The main problem confronting German air warfare in the Second World War is already hinted at in the evaluation of the different tasks, co-operation with the army on the one hand, and the fight against the enemy's sources of strength on the other: where will the autonomous operational air forces be more successful? In indirect and, to a limited extent, in direct support of the other services, primarily of the army, or in operations against the enemy's sources of strength, to stop his flow of strength at its source and not as late as on their way to the front, or – an even more difficult task – at the front lines themselves.

LDv 16 says that operations against the enemy's source of strength do have a decisive influence on the course of the war as such, but it also warns that: 'These operations in many cases tend to produce results only very slowly, and there is the inherent danger that they come too late to influence army and navy operations. They also normally require the commitment of strong forces over a long period of time.'

This wording is interesting for two reasons, because, firstly, it illustrates a realistic assessment of the effects of contemporary weapons and thus of the duration of a strategic air war directed against the enemy's potential and, secondly, it expresses the typical continental experience of Prussian Germany, which had always tried to achieve a quick decision on the battlefield and, indeed, had to try to arrive at a quick decision in view of the First World War, an experience that had shown it could not undertake a protracted war because of inadequate resources.

Time was never an important factor for the Anglo-American naval powers, whose strength always grew in the course of a war because they first had to mobilise their resources, dispersed over the whole world, and then eventually achieved overwhelming capabilities. Because the naval powers were aware of the crucial importance of resources, they created their bomber fleets for offensive strategic operations against those resources.

In relation to operations aimed at a quick decision, the operation of the independent operational Luftwaffe against the resources of power, or – as would have been the more accurate word in Luftwaffe terminology – strategic air warfare appeared to be of secondary importance. But here we have to ask what was meant by the terms 'strategic' and 'operative'? Was operational air warfare, in the final analysis, not just conducted to support army operations to the detriment of strategy? Undoubtedly, failure to define both terms clearly resulted in one being used for both, namely 'operative'; this had grave consequences from 1941 onwards.

The central idea in LDv 16 is, however, the offensive. The manual clearly states: 'Attack is to take precedence over everything else.' 'Offensive operations in enemy territory are indispensable', since 'only offensive operations will hit the enemy at the very roots of his power'. And further, 'Our own armed forces and our country are continuously threatened by the enemy's air forces. This threat can never be met by defensive measures alone taken within our country. The air threat to our own country calls for offensive operations by combat forces against enemy air forces on their territory.'

If a final assessment is to be made of the German approach to air warfare in the mid-1930s, it would be that the primary idea was to gain air superiority and, subsequently, the provision of extensive long-range operational support to the army, with selective elimination of the most important military and strategic armament targets. Only thereafter was direct support of the other Wehrmacht services envisaged.

Directly assigned to the army were:

- 30 reconnaissance squadrons for the armies;
- 32 heavy and 11 light Flak detachments; and
- 4 air signal communications detachments (motorised).

This was a sizeable portion of all Luftwaffe forces.

The next stage in the development of successful support for the army was executed during the Spanish Civil War, where the Condor Legion, commanded by von Richthofen, recognised, for the first time after the First World War, the possible benefits of large-scale close air operations and successfully tested and developed the doctrine of employment. Richthofen's concept was to create a special tactical air force for ground-attack operations: this force was to complement an independent operational Luftwaffe. His plan initially met with strong opposition, and his idea

of direct support of the army took a long time to be implemented in the form he had conceived.

The insecurity of Luftwaffe commanders was brought to light in a statement by the young Chief of the Luftwaffe General Staff, Jeschonnek, made during a General Staff Ride in June 1939, to the effect that direct support of the army was the most complicated task one could assign to the air force. Jeschonnek, a confirmed practician, had gained first-hand knowledge of the problems connected with co-operation with the army, a joint command organisation, communications and operations proper. In certain situations he believed it might be useful to appoint a special air-force commander (Fliegerführer z.b.V.) and place the air units designated for support of the army under his command.

With one long-range fighter, one assault and four dive-bomber groups of Ju 87 and an additional fighter group, in the campaign in Poland, Richthofen was able to confirm the experience gained in Spain, namely that, with air superiority, notable successes could be achieved on the battlefield. Another of Richthofen's ideas also proved correct: to immobilise the enemy with the greatest possible concentration of striking power and always gain local air superiority at the focal point of the front, in other words to establish resolutely points of main effort. Richthofen achieved recognition when the provisional 'Fliegerführer z.b.V.' he had created was first upgraded on 1 October, at the end of the campaign in Poland, to the status of an Air Division Command (8th Air Div.), and, only a few days later, on 5 October, was redesignated VIII Air Corps.

In France, the Air Force could not overcome the almost omnipotent army with such a concept. It was mostly seen as a supplementary service, and was split up and put under control of the major army units. Even De Gaulle regarded it as an auxiliary force. Its organisation was modelled upon that of the army. The French realised that air superiority – which they wanted to gain in the air battle – was a prerequisite for success, and also realised the importance of interdiction, although direct support was more or less left to the artillery. Co-operation between the Army and the Air Force was primarily a matter of air cover and reconnaissance. There were no absolute priorities for the Air Force; it was the army that determined organisation and operations in a rather narrow-minded fashion.

The French air forces, tied down and forced into a straitjacket, then had to face the German offensive in May 1940. Organised

into Air Fleets 2 and 3, the strength of the German forces was over 1,000 twin-engine bombers, about 460 dive-bombers and assault aircraft, and over 1,000 fighters and about 250 twin-engine long-range fighters.

Let us now consider the General Staff Ride of 1939, conducted by Jeschonnek. At that time, on the problem of fighting the enemy air force, he had stated categorically that support for the army in the first days was not as important as fighting the enemy air force; what could be achieved against the enemy army in the first two days could, according to Jeschonnek, in no way compensate for the damage an operational enemy air force could inflict if it turned against the German lines of communications. In this connection, Jeschonnek called for employment of as strong a force as possible, including all reserves, in the first raids of the offensive.

Studies I conducted to verify this position revealed that Air Fleets 2 and 3 did indeed attack a total of 83 enemy airfields on 10 and 11 May in France, Belgium and the Netherlands, destroying some 732 enemy aircraft and incurring losses of 125, according to the Luftwaffe. On 12 May (the third day of the offensive), although Germany was progressively gaining air superiority, it was only 12 airfields, and the enemy lost another 213 aircraft, while Germany lost 32 aircraft. During the remaining 8 days of the offensive up to 20 May a total of only 87 airfields were attacked; as early as 16 May the reports simply said: 'Friendly air superiority'.

A typical example of the situation in the air was 13 May, when a total of only 4 airfields were attacked; and that was just the fourth day of the offensive. That day German troops forced their crossing over the river Meuse, which would have been almost impossible without concentrated attacks by Air Fleet 3. Especially attached for this operation was von Richthofen's VIII Air Corps; the approximate number of 700 aircraft employed in the operation, including no less than 200 dive-bombers, is exemplary for the establishment of a point of main effort.

Michel Forget's paper clearly illustrated the reasons for the organisational fragmentation of the French air forces. In May 1940 this prevented the French forces from playing a more effective role in the fighting, despite their numerical strength, the basically very good technical state of their aircraft and the training of their pilots. By way of example, the fighter forces were not only proportionately distributed among the individual armies, from which they received their orders; they were, at the

same time, controlled by the 'Commander of the Air Forces Assigned for Cooperation attached to the Chief of the Army General Staff'.

The consequences of this are illustrated by the examples of 13 and 15 May, the crossing of the river Meuse. Here, we must bear in mind the absolutely clear main effort of the offensive, established by Air Fleet 3 with more than 700 aircraft on one day and against one target. In contrast, the French historian Goutard, writing of 15 May, the day on which the French High Command realised the full extent of the danger facing its armies fighting in Belgium, states that the commander of the air force attached to the French 1st Army Group was ordered to distribute his fighters among four armies. At the same time, the 'Air Force Commander with the French Forces High Command' ordered him to distribute the same forces over three, partly different, areas. Goutard adds: 'At the same time, however, he received urgent requests for assistance from the different armies.' Conclusion: units make their requests primarily as their situation requires; the command, on the other hand, must think and act in terms of the main effort.

In Forget's opinion this campaign was a 'brutal punishment' for the deficiencies of French doctrine. And it will hardly be any consolation to him that two and a half years later the US air forces in North-west Africa operated with the same inadequate concept, which was too army-oriented, and had to learn the hard way, as illustrated above. The difference there, however, is that the United States, being a world power, could take the blow and still find time to implement the lessons learned from her mistakes. That was not possible for the continental power, France, in 1940. She was defeated in a land battle to which the Luftwaffe had made a major contribution.

The same doctrinal principles were applied in 1941 in the campaign in the Balkans. These campaigns reveal the following characteristic features of German air operations:

- The initial Luftwaffe strike was a surprise attack on the enemy air force, including its ground organisation, to gain air superiority right from the beginning. This first blow was often also directed against the enemy capital to eliminate the centre of government.
- While conducting further attrition operations against the enemy air force, the next strike was directed against such vital points as supply depots, traffic centres and military camps; it was,

therefore, already serving the land battle in the broadest sense, and was in line with its major objectives; as Jeschonnek said, this had to be co-ordinated by Luftwaffe and army commanders-in-chief (i.e. at the level of the higher command) and then arranged in detail by the Air Fleets and the Army Groups.

- The offensive air units provided extensive indirect support of the army with long-range operations in the enemy's rear, where they conducted interdiction operations against lines of communication and supply manoeuvres, and tried to keep the enemy's contingency reserves from reaching the battlefield; at the same time, the fighters sealed off the area above the ground battle within their range of operation.
- Finally, at the main effort of the ground offensive, the tactical units of dive-bombers, assault aircraft, twin-engine bombers and fighters provided concentrated support right from the start of the battle to allow the motorised units to achieve swift breakthroughs and gain, as quickly as possible, operational freedom to press ahead with the offensive.

In the campaigns against Poland, France and in the Balkans this was the decisive contribution of the Luftwaffe to the German operations against local, continental European enemies. In all cases where they were dealing with states which could be attacked by air forces and, at the same time, be overrun by mechanised forces the German concept proved highly successful.

In view of a strategy which allowed the attainment of the 'objective of war', that is, victory over the enemy, in such a combined air-land battle, one might be tempted to regard the question of the relationship between and the influence of strategic and tactical air operations as a merely academic one. In these three battles, the enemies were defeated in a land battle and their territory was occupied. We may well conclude that such a strategy may be appropriate for local continental enemies - it is certainly not appropriate in a conflict with world powers or alliances of world-wide dimensions.

However, in all cases adequate aircraft are required, and that was something the Luftwaffe did not possess in the Second World War. Apart from the largely unsuccessful development and production of a four-engine bomber, which became the cornerstone of the Allied air effort, the political leadership, who for years gave the impression that they wanted to avenge

themselves on what seemed at the time to be their continental European enemies for the injustice of the Versailles settlement of 1919 must also be blamed for the conviction of the Luftwaffe leadership that the twin-engine Do 18, He 111 and Ju 88 bomber aircraft were sufficient for fighting wars in Central Europe.

These assets were insufficient in the 'independent air war' in 1940-1 against the British Isles, in which they were repulsed by the English air defence, and they were even less adequate from 1941 onwards when the European war became a World War. Although the previously successful concept proved effective in a series of ground battles against the Soviet Union, inflicting extraordinary defeats on her in Operation Barbarossa, in the end it failed to defeat that huge country in the land battle.

The exhausted German Army was becoming increasingly dependent on direct support from the Luftwaffe, degrading this service more and more to an auxiliary arm of the ground battle. Eventually, this reality settled the problems of strategic versus tactical operations without further ado.

PART VII

Intelligence and Air Warfare

25

The Air Defence Gap: British Air Doctrine and Intelligence Warnings in the 1930s

Wesley K. Wark

The prospect of a fatal vulnerability to air attack – an ‘air defence gap’ – has dogged strategic planners and political leaders since the advent of air power in the First World War. Such vulnerability has usually been measured within the context of the rival technologies and capabilities of air power and air defence; historically, the presumption has often been in favour of the power of the offensive. The strategic proclivity, combined with the generally reactive nature of progress in the realm of air defence, and the tendency of planners to construct worst-case visions in times of military uncertainty or crisis, has served to make air defence gaps, real or imagined, a perennial feature of the national security debate. The perception of vulnerability to air attack in any era is a phenomenon worth studying, both in terms of the way in which a vision of defencelessness is generated, and in the measures taken to meet the threat. This chapter seeks to examine some aspects of the phenomenon of the air defence gap, as it was understood in Britain in the 1930s. Paradoxically, an exaggerated conviction of vulnerability in Britain was to serve as the necessary stimulus for the creation of a defensive system which would upset all the orthodox calculations about the supremacy of the offensive.

During the First World War, an *ad hoc* system of air defence had been developed in Britain in reaction to the threat from first Zeppelins and then the Gotha bombers targeted on selected cities by the Germans. The Zeppelins were a military nuisance, and eventually succumbed to the defensive capabilities of aircraft armed with explosive and incendiary bullets. By early 1917

the balance of advantage in air warfare seemed to have shifted decisively to the defensive. The achievement of air security, however, was short-lived. New technology generated a renewed challenge to the effectiveness of Britain's air defences. On 13 June 1917 a squadron of 14 twin-engined Gotha bombers flew up the River Thames in broad daylight and in neat diamond formation, dropping TNT and incendiary bombs on London. A total of 92 Royal Flying Corps (RFC) aircraft took to the air to meet this blatant raid, but not a single plane managed to intercept the German formation successfully.¹ A second major raid on 7 July 1917 by the Gotha bombers underscored the message. This time 95 RFC planes attempted to engage the German attackers, but again with little success. Only one Gotha was shot down, and that almost accidentally.² Nor did the anti-aircraft guns now deployed around the outskirts of London in considerable numbers prove a promising weapon. In fact they caused more damage to the London population than they did to the German bombers. In the aftermath of the raid it was discovered that unexploded AA shells and fragments had killed 10 civilians and injured another 55.³ Total casualties for this second raid were 54 killed and 150 wounded. Here was an air defence gap with a vengeance.

The apparent defencelessness of London against the new bomber threat, combined with the public outrage created by the casualty toll, which included eighteen school children, served as a catalyst. The War Cabinet instituted a number of emergency measures to improve the air defences of London, which included, among other things, the withdrawal of some RFC squadrons from the Western front.⁴ The imaginative mind of General Jan Smuts was put to work to come up with long-term solutions to the air menace. His emphasis on massive fire-power, through the employment of anti-aircraft barrages and formations of fighter squadrons, while reflecting the military experience of the day, set in motion a complete overhaul of Britain's air defences.⁵

By the end of the war, Britain was in possession of a well-integrated air-defence network, whose main components consisted of: an early warning system, linking Observer Corps posts and sound locators by telephone lines to a central London Air Defence Area control room (LADA); a command structure which maintained a series of plots of reported enemy raiders and directed fighters to their targets by wireless; and a protective screen deploying balloon barrages, searchlights, anti-aircraft guns and fighter squadrons.⁶ The air-defence system

was an impressive achievement, but it came too late. The trouble was that the German air effort dwindled away in the spring of 1918, before the system could be tested in earnest.

With the coming of peace, the air-defence system was rapidly demobilised and dismantled. Although Winston Churchill, then Secretary of State for War and Air, warned in 1919 that 'it is essential to keep alive the intricate and specialized art of air defence', little was done.⁷ By 1920 not a single AA battery existed to defend London, the balloon barrage had been stored away to rust and rot, the searchlights were turned off, and the fighter squadrons were reduced to a virtual training establishment. What survived, instead, was the memory of vulnerability to air attack. In part this was due to the trauma of the first experience of air warfare targeted against a civilian population; in part it was due to the historical accident whereby the wartime air-defence system, developed from 1917 to meet the new bomber threat, never enjoyed an opportunity to prove itself.

In the circumstances of post-war disarmament and pacific sentiment which governed the British outlook in the 1920s, the memory of vulnerability to air attack might simply have become a bad memory, of declining vividness. It was, however, to be sustained by the force of popular culture, and was given a new life by its incorporation into the official thinking of the newly established Royal Air Force. The RAF, under the energetic leadership of the Chief of the Air Staff, Air Marshal Sir Hugh 'Boom' Trenchard, was a new arm of war in search of a strategic doctrine. The doctrine which the RAF embraced in its first decade combined an assumption about the vulnerability of Britain to air attack with an offensive spirit which saw in the strategic counter-attack, conducted by fleets of bomber aircraft, the best means of defence.⁸ Air-defence schemes drawn up in Britain after 1923, while never neglecting the requirements for purely defensive means, reflected this strategic orthodoxy by concentrating the RAF's limited resources on the construction and maintenance of bomber squadrons. Throughout the 1920s, the RAF worked on the creation of an approved peacetime force of 52 squadrons – with a metropolitan first-line strength of 394 bombers and 204 fighters, a proportion of bombers to fighters of two to one.⁹ The fifty-two squadron scheme itself reflected another strand of the new strategic orthodoxy, namely the application of a One Power standard to the measurement of air strength.¹⁰ The terminology was borrowed from the realm of

naval power, and defined the achievement of parity in air strength with the forces of a potential enemy as the essential minimum for security.

Altogether, the post-war British doctrine of air power was curiously out of keeping with its time. It was rooted in a distorted reading of the lessons of the First World War, in which vulnerability to air attack overshadowed the achievements of air defence; it involved a futuristic act of faith in the destructive power of a strategic air offensive, at a time when the technology available scarcely lent itself to such a mission; and it defined a measure of air strength, air parity, the implications of which were not fully thought out, and which in any case was directed against an imaginary 'potential' enemy. In the 1920s that so-called enemy was Britain's wartime ally – France. It is perhaps not unfair to characterise the post-war air doctrine as an academic and bureaucratic exercise, designed to justify a long-term strategic role for the RAF and ensure the requisite finances to maintain the RAF's independence against its real foes – the Royal Navy and the Army.

The rebirth of German air power with the advent of the Hitler regime and the rise of global tensions in the early 1930s transformed an academic and bureaucratic exercise in air-power thinking into a matter of vital national security. Britain's air defences were in a parlous state when the decade began.¹¹ The metropolitan air force was ten squadrons short of its 52-squadron establishment, and was equipped with aircraft best suited for colonial 'air interdiction' missions. The British aircraft industry had shrunk to a small, partly government-supported ring of manufacturers under the impact of declining orders in the 1920s. The anti-aircraft defences were equipped with First-World-War vintage weapons, and the territorial brigades detailed to man them were badly under strength and ill-trained. The Observer Corps, the only available system for early warning of air raids, had slipped into total secrecy in a hostile public environment. The few surviving volunteer civilian groups had grown used to clandestine habits, and mobilised themselves for infrequent air-defence exercises by the expedient of posting cards in local Post Office windows which read 'Forewarned is Forearmed' and gave a date and time.¹²

To repair these deficiencies and to meet what was from the beginning taken as a serious German threat, the British government embarked on an air-rearmament programme in 1934.¹³

That rearmament was conducted, inevitably, within the framework of the strategic doctrine inherited from the 1920s. The emphasis was on the creation of a powerful bomber force and the maintenance of air parity with an expanding Luftwaffe, in order to deter Germany from war or, if necessary, to inflict massive counter-offensive damage.¹⁴ The assumption continued to be that Britain was especially vulnerable to air attack, given the geographic tightness of the island and the concentration of civic and economic life in the inviting target of London. The best form of defence was to be the offence.

This air-power orthodoxy was firmly entrenched in the official, military and public minds. Stanley Baldwin, the British Prime Minister, gave expression to it in his famous apocalyptic statement that 'the bomber will always get through'.¹⁵ The air staff promoted a vision of the potency of a German 'knock-out blow'. In a memorandum of July 1934, the Chief of the Air Staff warned that:

All we know about German air plans suggests that . . . there is a considerable school of thought in Germany to-day which believes that a 'knock-out blow' is possible and seems inclined to favour that mode of attack. . . . In a war in which this country and France are resisting German attack it is reasonable to assume that, owing to the exposed position of London, Germany would direct her initial attacks against this country and for that purpose she would concentrate against us at least two-thirds of her total bomber force.¹⁶

The Chief of the Air Staff also reiterated the belief that air attacks could not be warded off completely by a defence system; such attacks could only be 'negated by the provision of superior strength in bombing aircraft'.¹⁷ Air-power pundits ensured that this orthodoxy would reach the public. In a mass-circulation paperback, a 'Penguin Special' volume entitled *The Air Defence of Britain*, published just after the Munich crisis, Air Commodore L. E. O. Charlton reminded his readers that 'it is fearfully apparent that London is the Achilles' heel of our defence, by striking which, and striking hard, they [the Germans] might not vainly claim to lay us low'.¹⁸ Elsewhere the Air Commodore gave a confident insight into German plans. 'We may be sure . . . that the plan is laid. London will be the enemy's main objective, for it is a prize within the grasp, so easily can it be obtained, and to imagine otherwise were to deny common sense to a powerfully situated and crafty foe.'¹⁹

Deeply rooted as was this air-power outlook in Britain, the most critical development of the 1930s proved to involve the revolutionary upset of the doctrine, and with it a revolutionary change in the nature of British air-rearmament. The decade of the 1930s witnessed a slow shift in air policy in Britain from emphasis on the counter-offensive to emphasis on defensive measures—a shift cloaked in a considerable degree of obscurity. The motive forces behind this change were varied, but ultimately critical to it was the emergence of a new air defence gap.

The unravelling of the air-power doctrine was compelled, in the first instance, by the grudging and painful recognition that the concepts of air parity, the counter-offensive, and defence vulnerability were of increasingly doubtful validity in the circumstances of the Anglo-German air arms-race. Air parity was the first victim. Although early RAF rearmament programmes were directed towards the achievement of long-term numerical equality with the Luftwaffe, the goal eluded the air force. Faulty intelligence predictions, which served to underestimate the pace at which the Luftwaffe would expand, combined with difficulties in industrial supply and financial procurement, and the air staff's outlook on the need for a controlled RAF growth in which professional standards would not be sacrificed, all contributed to the RAF's falling behind its Luftwaffe rival in first-line strength.²⁰ By 1936, on the basis of intelligence assessments, the air staff conceded that the air arms-race was lost, and that parity could not be achieved in the near future.²¹ Thereafter, although the policy of air parity was never officially abandoned, the timetable for its achievement was extended into the early 1940s. The rather desperate expedient of redefining parity to suit the RAF's strength served only to thinly disguise the reality.²² Loss of air parity stimulated the pursuit of appeasement, culminating at Munich in September 1938, and so damaged British foreign policy. But it also helped liberate the air force from an inappropriate doctrine.

A parallel development took place in the RAF's vision of the counter-offensive. The development of plans for a strategic air offensive against Germany was much delayed, planning beginning seriously only in 1937. As the official historians relate, the process of drawing up detailed plans brought the RAF's Bomber Command 'down to earth'.²³ By October 1937 a list of thirteen war plans was ready and sent down to Bomber Command for analysis. Some of the plans no doubt appeared peripheral, among them the one that called for an incendiary attack on

German forests. Three plans were given priority. These called, respectively, for attacks on the German air force and its maintenance organisations; assaults on German military communications, especially the railway system; and an offensive against the German war industries in the Ruhr.²⁴ A former air attaché to Berlin, Group Captain Don, was put in charge of the survey, which, again according to the official history, 'brought to light the hard realities of the problem for the first time and revolutionised the thinking not only of Bomber Command but of the Air Staff itself'.²⁵ By the time the Munich crisis confronted the British government with its first real prospect of a major war with Germany, the chief of Bomber Command, Air Vice-Marshal Sir Edgar Ludlow-Hewitt, was warning the Air Ministry that his squadrons had scarcely any offensive capability, and that Britain would have to rely on her fighter and AA defences for protection.²⁶ This revelation, no less than the loss of air parity, was damaging to the prospects of a forceful British diplomacy, but did also serve, although in desperate fashion, to liberate British air strategy.

The gradual loss of air parity and the dawning realisation of the difficulties ahead for the RAF in conducting a strategic bombing offensive were background influences of considerable force in the revolutionary shift from an offensive to a defensive air-power doctrine. But the most immediate and identifiable motive force in this shift was occasioned by a new perception of an 'air defence gap'. The counter-offensive strategy which had dominated air-power thinking for most of the inter-war period was founded on the twin assumptions of the vulnerability of Britain to air attack and of the tremendous psychological effect of air bombardment, which Trenchard himself prophesied would exceed the material damage by a factor of three to one.²⁷ Fundamental to this strategy was the notion that a potential enemy would be equally vulnerable to air attack, both geographically and psychologically. When Germany emerged in the early 1930s as Britain's 'ultimate potential enemy', questions were raised about the relative vulnerability of the two states, especially as Germany offered no target so tempting or accessible as London. Such doubts were quietened by reference to the exposed position of Germany's industrial heartland, the Ruhr.²⁸ But this notion of mutual vulnerability as a key element in strategic doctrine and, indeed, in the air-power balance, was suddenly undermined by a series of reports on German air defences which arrived in Whitehall in the autumn of 1937. The impact of

these reports was due not merely to their subject matter, but also to their timing. They arrived in the midst of a major review of British rearmament programmes and defence spending conducted by the Treasury and by the Ministry for Co-ordination of Defence. The fear of a critical air defence gap came at just that moment when hard choices were being forced on British arms programmes by the runaway escalation of defence spending.

The War Office, the Air Ministry and the Air Raid Precautions Department (ARP) of the Home Office all had intelligence sections which studied aspects of the German air-defence system. The rough division of labour saw the War Office responsible for reporting on the German anti-aircraft-gun defences, the Air Ministry for fighter forces, and the ARP department for passive defence measures. There was no effective co-ordination of these reports, a problem endemic to the British intelligence system.²⁹ This circumstance dictated that German developments would be followed piecemeal, but also made it possible that single reports, if dramatic enough, would compel attention and create alarm.

Although German anti-defence measures had been studied since 1933, and the ARP department had been active in surveying passive defence systems since the onset of the Spanish Civil War, the alarm was sounded in Whitehall only in September 1937, with the reception of a report on 'German Anti-Aircraft Defences'.³⁰ The genesis of this report can be traced to an official visit to Berlin undertaken by two officers of the ARP department's Intelligence Section, Major F. L. Fraser and Mr H. Ryle. These two officers, given what was apparently the full German propaganda treatment, came away highly impressed. They presented a factual report on German air-raid precautions which listed the German achievements in such fields as organisation of the population, finance, training and exercises, recruitment, shelter construction, anti-gas measures, fire-fighting, evacuation, medical services, railway defence measures, and early warning.³¹ No specific conclusions or policy recommendations were put forward in the report. As for sources, it was apparent that in addition to the conducted tour of inspection carried out by Fraser and Ryle, the ARP department's Intelligence Section was dependent upon German official publications and newspaper accounts for most of its information. The impression left by this document was one of a massive and disciplined air-defence system fully mobilised in Germany.

Whether this factual report, on its own, would have drawn

much attention is doubtful. However, Fraser and Ryle deposited a copy of their report, no doubt as a diplomatic courtesy, with the British embassy in Berlin. There it was seized upon by the *Chargé d'Affaires* in the embassy, Sir George Ogilvie-Forbes. The *Chargé* reported on it immediately to the Foreign Secretary, Lord Halifax, while his chief, Sir Nevile Henderson, a man immune to any alarms about German policies, was away on vacation.³² It was Ogilvie-Forbes who spelled out the implications of the report's depiction of an air defence gap. Drawing in addition on the air attaché's knowledge of German defences, Ogilvie-Forbes painted an impressive picture of the Third Reich's air-defence system, and did not hesitate to draw comparisons between the advanced state of German preparations to meet an air attack, and the backward condition of British air defences. The *Chargé* warned that 'the state of affairs disclosed by Major Fraser's and Mr Ryle's report is one which calls for a radical readjustment of existing theories in regard to Germany's power in the air'.³³ His conclusions were even more forthright:

It will, I am sure, be appreciated that, faced by this formidable mechanism of defence, any forces which Great Britain might be obliged to despatch against this country would produce a far less staggering impact than might at one time have been hoped. Not only this, but the curve of their decline in offensive power as the defence took its inevitable toll would be a rapidly progressive one. On the other hand, taking Major Fraser's report as a basis, it is reasonable to suppose that the German squadrons, even if they were no more than equal in speed and in striking power to our own at the outset, would achieve far more dangerous results and would continue to do so for an indefinitely longer period. Such a state of affairs is one which is grievous to contemplate, but which appears nearly inevitable unless full account be speedily taken of the enormous advantages which Germany possesses in her protective organisation.³⁴

Such forceful language ensured that the air-defence report would receive a hearing in Cabinet, and both the Foreign Secretary and the Home Secretary circulated copies of the documents to the relevant Cabinet committees. Minutes of a meeting held by the Committee of Imperial Defence to discuss the matter record in unmistakable fashion the strong impression that the German air-defence measures made on Cabinet Ministers. The Home Secretary, Sir Samuel Hoare, sounded almost a defeatist note by warning the Cabinet that in present circumstances

British defences could do little to combat either the onset of panic during air raids or the stoppage of essential industries.³⁵ Lord Swinton, the Air Minister, expressed his amazement at the degree of organisation that Germany had attained in air defence. As Swinton put it, 'everyone in Germany has an ARP job or responsibility'.³⁶ Only the cautious Chancellor of the Exchequer, Sir John Simon, remained unmoved, calling attention to the fact that the reports on German defences made no distinction between what Germany intended to do, and what systems were fully ready at the moment. Simon also noted that the Cabinet was responding to reports from civilian authorities, and needed a considered appreciation of the situation from the air staff.³⁷ In this spirit it was decided to pass the documents to the Chiefs of Staff for study.³⁸ But the unfolding of events was to preclude either a careful military study of the air-defence balance, or sufficient attention being paid to the cautionary advice from Simon. The situation seemed to demand an urgent response.

One week after the air-defence reports were sent to the Chiefs of Staff, and without any military appreciation being available, the Prime Minister, Sir Neville Chamberlain, called an emergency meeting of a small, *ad hoc* group of Ministers at No. 10 Downing Street to consider the state of British air defences. It was this meeting that translated fear of an air defence gap into action. But it is also at this point, unfortunately, that the documentary evidence is least satisfactory. No minutes of the meeting have survived, presumably because it was an *ad hoc* and hurried gathering. While we thus lack insight into the state of mind of key Ministers at this time, we do at least have on record their collective decisions. These called for the War Office to give absolute priority to anti-aircraft defences, and instructed Sir Thomas Inskip, Minister for Co-ordination of Defence, to expedite with all possible speed the programme for provision of anti-aircraft armaments.³⁹

These decisions, in turn, had an important impact on the shape of the defence review conducted by Sir Thomas Inskip in the autumn of 1937. Inskip had been given the task of finding an appropriate balance between economic stability and rearmament measures in British defence policy: in other words to define an affordable defence system for the country.⁴⁰ Central to this task was the need to define defence priorities. Influenced by the immediate concerns about an air defence gap, and long-range considerations about Britain's limited financial resources,

the Minister for Co-ordination of Defence spelled out in his report to Cabinet the principal objective as the defence of Britain against air attacks. 'The greatest danger against which we have to provide', Inskip stated, 'is attack from the air on the United Kingdom, designed to inflict a knock-out blow at the initial stage of a war.'⁴¹ To put this precept into practice, Inskip was forced to veto increased expenditure to allow the Admiralty to expand the fleet. Furthermore, Inskip officially defined the Army's first priority as the provision of anti-aircraft defence. But the service most affected by Inskip's findings was the air force. Inskip called into question the validity of the RAF's counteroffensive strategy, and recommended that the emphasis in the air-rearmament effort should be shifted from bomber squadrons to fighter squadrons.⁴²

Inskip's report sent shock waves through the defence establishment, and aroused a protest from the Chiefs of Staff. The military called for a more forceful pursuit of appeasement, and a radical change in the government's economic philosophy to accommodate the production of 'guns' at the expense of 'butter'.⁴³ Despite the vigorous military dissent, backed in part by the Foreign Office, the Inskip report found early approval from the Cabinet.⁴⁴ Gripped by concerns about an air defence gap, the turn to defensive measures to restore the situation seemed the logical course of action.

The revolutionary change in air-power policy, inaugurated in this fashion in the autumn of 1937, was consolidated by the threatening political developments of 1938. The German military occupation of Austria in March 1938, itself taken as the signal for the onset of the Czech crisis, prompted the government to throw off all financial restrictions on air rearmament. This, too, was a radical step. It was estimated that under full-production conditions some 12,000 aircraft could be produced within a two-year period. Production up to this maximum figure was authorised by the government in April 1938.⁴⁵ Subsequently, the events of the Munich crisis, in which Britain was propelled to the brink of war while fully cognisant of the inadequacy of her defence preparations, gave added force to the perception of an air defence gap and full conviction to the need for improved air defences as the first priority.

The British ambassador to Berlin, Sir Nevile Henderson, in a letter to the Foreign Secretary, summarised the lessons of the Munich crisis as he saw them: 'There is no doubt in my mind that Hitler's intransigence and readiness to embark on war was

solely due to the conviction that Germany, as result of Goering's efforts possessed (1) an air force which in quantity and quality surpassed anything England could put up and (2) an immeasurably superior ground defence.⁴⁶ In the aftermath of the Munich crisis, even the Air Ministry became convinced of the need to concentrate on immediate measures of air defence. A review of Munich crisis deficiencies, conducted by the air staff and presented to the Cabinet, concluded with the Secretary of State's notice of the RAF's future intentions. Given the possibility of a further European crisis threatening war in the near future, the Air Ministry proposed to 'give priority to building up our fighter forces as soon as possible with fully adequate reserves'.⁴⁷

The air defence gap, though drastically conceived, was, like the loss of air parity and the faltering belief in the efficacy of a strong air offensive, ultimately liberating. Its impact on the shift from bomber to fighter production was decisive, and outweighed either economic or technological factors. The standard account that the British shift to fighter production was a product of a singular Cabinet drive for cost-effective air programmes is belied by the evidence.⁴⁸ The fighter squadrons were given priority not because they were cheaper to build and could be produced more quickly than the bombers, but because they were seen as the only solution to the air defence gap. Technological factors, such as the vastly improved interception capabilities of the Hurricane and Spitfire generation of fighter planes, and the potentiality of the chain of radar stations then under construction to provide a completely unanticipated degree of early warning, curiously enough do not appear to have influenced the revolution in air policy.⁴⁹ Perhaps the pace of technological change had been too great for even the 'air-minded' generation of the 1930s to comprehend fully. In the case of radar, at least, this lack of impact can be ascribed to the tremendous degree of secrecy which surrounded the project.

The policy which resulted from the perception of an air defence gap helped to ensure that, when the air contest with the Third Reich did come, the RAF possessed a well equipped and well integrated air-defence system. The shift in priorities paid off. At the time of the Munich crisis, Britain could deploy no more than 29 fighter squadrons, only six of which were equipped with the latest fighters (the Hurricanes and Spitfires). First-line fighter strength was roughly 406 aircraft, but over 50 per cent of this force was deemed obsolete or obsolescent. Reserves of

aircraft were very low, and shadow-factory production was not yet fully under way. The incomplete radar chain could provide only very partial coverage of British air space. The balloon barrage was only one-third complete. Heavy anti-aircraft guns, mostly of First-World-War vintage, numbered 334 in total; but this figure was only a third of the desired strength. Scarcely any light anti-aircraft guns existed to provide protection against low-flying attack. A total of 1,430 searchlights were available, but this represented a shortfall of 65 per cent of requirements. The important command and control system pioneered by Air Marshal Sir Hugh Dowding was untested, and the operations rooms, the nerve-centre of the fighter-defence system, were as yet unfinished. Altogether it was a melancholy catalogue of weaknesses which the government had to face in September 1938: one sufficiently alarming to block any realistic appreciation of the limited German offensive capabilities.⁵⁰

For the Battle of Britain, less than two years later, although Germany's air strength had increased and her strategic position improved, the British air-defence system was changed out of all recognition. Despite losses in the Battle for France, the RAF could deploy a first-line strength of 660 Hurricanes and Spitfires (a threefold increase in modern fighters), backed by plentiful reserves and a healthy production output. A chain of 51 radar stations gave effective early warning of air raids. The balloon barrage, whatever its merits, was at strength. Over 1,000 heavy anti-aircraft guns and 581 light guns were in place, along with some 3,000 searchlights. Dowding's fighter-control system was fully operational.⁵¹ An effective air-defence network was achieved just in time. At the Battle of Britain, the RAF was able to bring superior defensive strength against an over-confident Luftwaffe, suffering from victory euphoria and a naïve belief in its ability to conduct a strategic offensive. The outcome of the Battle of Britain gave the lie to the Luftwaffe's own intelligence assessments, which had boldly concluded in July 1940: 'the Luftwaffe is in a position to go over to decisive daylight operations owing to the inadequate air defences of the island'.⁵²

The perception of an air-defence gap thus served an ultimately constructive and vital purpose. It remains to be noted that the perception itself, while it had a liberating effect from past dogma and a useful effect on future policy, was based on a myth. German air-defence measures were by no means as substantial as was credited by British observers. Although Goering's Luftwaffe developed, in the 1930s, an extensive AA system

based on heavy anti-aircraft guns (the famous dual-purpose 88 mm), and searchlights, the Germans lacked a useful radar early warning system and gave little priority to fighter defences.⁵³ The singular reliance on AA guns for defence and the lack of an integrated defence system which could match the British achievement reflected the cult of the offensive which gripped the minds of Hitler and Goering.⁵⁴ Fortunately perhaps, in the circumstances of the 1930s, the British susceptibility to the anxieties of the air defence gap provided the antidote to the RAF's own cult of the offensive.

Notes

1. Ian V. Hogg, *Anti-Aircraft: A History of Air Defence*, London, 1978, p. 53.
2. *Ibid.*, pp. 53-4.
3. *Ibid.*; H. A. Jones, in Walter Raleigh and H. A. Jones, *The War in the Air*, Oxford, 1922-37, Vol. IV, pp. 152-5.
4. D. Lloyd George, *War Memoirs*, London, 1933-6, Vol. IV, p. 1859.
5. H. Montgomery Hyde, *British Air Policy between the Wars*, London, 1976, pp. 29-33; the text of the Smuts report on 'Air Organization' is printed in Raleigh and Jones, *The War in the Air*, Vol. VI, Appendix II.
6. Hogg, *Anti-Aircraft*, pp. 60-3.
7. Quoted *ibid.*, p. 67.
8. Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive against Germany*, London, 1961, Vol. I, pp. 42-50, 54-5. A new interpretation of Trenchard's legacy can be found in Malcolm Smith, *British Air Strategy between the Wars*, Oxford, 1984, pp. 57-64. The standard work on Trenchard is Andrew Boyle, *Trenchard*, London, 1962.
9. Basil Collier, *The Defence of the United Kingdom*, London, 1957, p. 15.
10. N. H. Gibbs, *Grand Strategy*, Vol. 1: *Rearmament Policy*, London, 1976, p. 48.
11. Collier, *Defence of the UK*, pp. 17-20.
12. Hogg, *Anti-Aircraft*, p. 74.
13. Discussed in Gibbs, *Rearmament Policy*, pp. 102-10; the deliberations of the government committee responsible for formulating the first rearmament programme are in Defence Requirements Committee papers and minutes, 1933-4, CAB 16/109-110, Public Record Office. (All further references are to documents held in the Public Record Office, unless otherwise stated).
14. Deference was the particular theme of a small committee which aided the Cabinet in assessing the DRC report, see 'Report of the Sub-Committee on the Allocation of Air Forces', 11 July 1934, AIR 8/174.
15. Keith Middlemas and John Barnes, *Baldwin*, London, 1969, p. 735.
16. COS 344, 'The Potential Air Menace from Germany', 11 July 1934, CAB 53/24.

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17. COS 341, 'The Potential Air Menace to this Country from Germany', 12 June 1934, CAB 53/24.
18. L. E. O. Charlton, G. T. Garratt and Lieutenant-Commander R. Fletcher, *The Air Defence of Britain*, Harmondsworth, 1938, p. 33.
19. *Ibid.*, p. 38.
20. On intelligence predictions, see Wesley K. Wark, *The Ultimate Enemy: British Intelligence and Nazi Germany, 1933-1939*, Ithaca, NY, 1985; supply difficulties are considered in Robert Shay, *British Rearmament in the Thirties: Politics and Profits*, Princeton, 1977, and in George Peden, *British Rearmament and the Treasury 1932-1939*, Edinburgh, 1979; on the air staff's outlook, see Smith, *British Air Strategy*, pp. 153-6.
21. CID 1265-B, 'The Future of German Air Rearmament', 6 Oct. 1936, CAB 4/25.
22. An excellent discussion of the evolution of the air parity principle is contained in Gibbs, *Rearmament Policy*, pp. 539-53.
23. Webster and Frankland, *Strategic Air Offensive*, Vol. I, p. 91.
24. 'Planning for War with Germany', file AIR 2/2731; Plan WA1, the attack on the German Air Force, can be found in AIR 9/99; Plan WA5, the assault on the Ruhr, is in AIR 9/102.
25. Webster and Frankland, *Strategic Air Offensive*, Vol. I, p. 95.
26. *Ibid.*, p. 96.
27. *Ibid.*, p. 46.
28. This theme emerged in the discussions of the Deputy Chiefs of Staff (DCOS) committee in 1936 on a strategic assessment prepared by the Joint Planners. The debate can be followed in the minutes of the DCOS in CAB 54/1-3.
29. F. H. Hinsley, *British Intelligence in the Second World War*, London, 1979-88, Vol. 1, Chs 1-2.
30. COS 637, Annexe No. II, 6 Sep. 1937, CAB 53/34.
31. COS 637, Annexe No. I, 13 Sep. 1937, *ibid.*
32. Ogilvie-Forbes to Halifax, 18 Aug. 1937, in COS 637, Annexe No. II, *ibid.*
33. *Ibid.*
34. *Ibid.*
35. CID 299 mtg, 14 Oct. 1937, CAB 2/6.
36. *Ibid.*
37. *Ibid.*
38. Hankey to COS, 1 Nov. 1937, COS 637, CAB 53/34.
39. CID 271-A: discussed in Gibbs, *Rearmament Policy*, pp. 466-7, though only in the context of supply problems.
40. Gibbs, *Rearmament Policy*, pp. 282-95; Peden, *British Rearmament*, pp. 41-3.
41. CP 316 (37), 'Defence Expenditure in Future Years', 15 Dec. 1937, CAB 24/273.
42. *Ibid.*
43. COS 227 mtg, 19 Jan. 1938, CAB 53/8; COS 683, 'Military Preparedness in Relation to Imperial Defence Policy', 11 Feb. 1938, CAB 53/36.
44. Cab. Cons. 5(38), 16 Feb. 1938, CAB 23/93.
45. Gibbs, *Rearmament Policy*, pp. 579-80; Cab. Cons. 21(38), 27 April 1938, CAB 23/93.
46. Henderson to Halifax, 12 Oct. 1938, C14560/1425/18, FO 371/21710.
47. CP 218(38), 25 Oct. 1938, CAB 24/279.

48. This is the view of the official historians, Webster and Frankland, *Strategic Air Offensive*, Vol. 1, p. 77; and is modified in the recent study by Smith, *British Air Strategy*, p. 190.
49. Gibbs, *Rearmament Policy*, p. 596.
50. Figures compiled from Smith, *British Air Strategy*, Table X; Collier, *Defence of the UK*, pp. 65-6; Hyde, *British Air Policy*, pp. 429-30; Hogg, *Anti-Aircraft*, Ch. 4; Williamson Murray, 'Munich 1938: The Military Confrontation', *Journal of Strategic Studies*, 2, 1979, pp. 282-302. On the problem of British air intelligence assessments at Munich see Wark, *The Ultimate Enemy*, pp. 65-9.
51. Figures compiled from Collier, *Defence of the UK*, pp. 147-54; Peter Calvo-coressi and Guy Wint, *Total War*, Harmondsworth, 1972, pp. 138-40; Hogg, *Anti-Aircraft*, p. 100.
52. Quoted in full in Derek Wood and Derek Dempster, *The Narrow Margin: The Battle of Britain and the Rise of Air Power*, Westport, Conn., 1961, p. 109.
53. Richard Overy, *Göring: The 'Iron Man'*, London, 1984, p. 173; Matthew Cooper, *The German Air Force 1933-1945: An Anatomy of Failure*, London, 1981, pp. 57, 81.
54. Richard Overy, 'Hitler and Air Strategy', *Journal of Contemporary History*, 15, 1980, pp. 405-21.

US Army Air Forces Intelligence in the Second World War

Robert Frank Futrell

This chapter is concerned with efforts within the US Army Air Forces during the Second World War to develop concepts and capabilities for air intelligence that were somehow different from traditional American military intelligence. The great American captains – Eisenhower, Bradley and Arnold – each attested the values obtained from knowing the enemy, but in the end there was no effort in the new United States Air Force to discover the institutional aspects of air intelligence. In fact, in 1950 Major General John A. Samford, who was to be the USAF Director of Intelligence, told his subordinates: 'There is no coherent philosophy or doctrine on Intelligence', adding 'There ought to be one.'¹ Samford sponsored studies that ended with a set of air intelligence principles, but in no manner encompassed the whole subject.² One considerable problem was doubtless the veil of 'Green Door' secrecy that surrounded signal intelligence (SIGINT). Now with knowledge of signal intelligence and code-breaking it is possible to look for the institutional aspects of air intelligence. In this chapter, however, I can do no more than sketch a first look at a subject deserving full treatment.

At the start of the twentieth century, after the war with Spain, US War Department intelligence began to be rationalised. Military thinking divided the subject into War Department intelligence or national intelligence, routinely maintained, and combat intelligence that would be developed on fields of operations by combat commanders. The US Army Field Service Regulations of 1910 described the division of the 'service of information' between that collected by the General Staff and that obtained in theatres relative to the position, strength and intentions of the enemy. As for indication of the enemy, the manual stated: 'The number of camp fires and the area over

which they are spread afford an estimate of the strength and position of the enemy.' Further: 'A thick and low cloud of dust indicates infantry; a high and thin cloud, cavalry; a broken cloud, artillery or wagon trains.'³ During the First World War US Army experience continued to emphasise front-line intelligence. 'Warfare with battle lines separated by short distances only, makes possible the early acquirement of information. . . . With us the simple methods, such as observation from the air and ground and the exploitation of prisoners and documents, have proved much more effective than the less direct means.' This was General John J. Pershing's characterisation of intelligence in his First World War report.⁴

After the First World War US Army Training Regulation 210-5, 'Combat Intelligence Regulations', was issued in 1926. It dwelt upon the process through which 'information' became 'intelligence'. Intelligence evaluation was most important: 'The facts concerning the enemy are of little value to the commander unless the intentions of the enemy have been determined. . . . The intelligence officer not only must know what is, but must predict what will be. From a complete study of all prior information of the enemy, his past actions, his present situation and attitude, a hypothesis must be made as to his future intentions and action.'⁵ In the early 1930s the US Army Command and Staff School at Fort Leavenworth, Kansas, began to teach that probable enemy actions should be determined from 'capabilities' rather than possible 'intentions'. In 1938, TR 210-5 was replaced by a basic field manual that was reprinted as War Department Basic Field Manual 30-5, 'Military Intelligence, Combat Intelligence', and this would remain in effect during the Second World War, the thought being that the principles of military intelligence were going to emerge as the conflict progressed. FM 30-5 contained a new emphasis on the role of intelligence in command decisions. A commander's decision was to be based upon: (1) his mission as affected by the enemy to be dealt with; (2) the terrain over which the operation had to be conducted; and (3) the means available for the execution of the mission. The field manual opted for evaluations based upon an enemy's capabilities rather than his probable intentions: 'The main object of the continuing study of the enemy is to determine his capabilities and, if possible, the line of action he has adopted.' Although intelligence was a staff responsibility of a G-2 general staff officer, intelligence was a command responsibility in the final analysis: 'Since intelligence constitutes a vital

element in the commander's estimate of the situation leading to any tactical or strategical decision it is a basic function of command to initiate and coordinate the search for the necessary information upon which to base decisions.⁶

In the US Army of the 1920s and 1930s intelligence officers did not have much prestige. General Omar Bradley recalled: 'Misfits frequently found themselves assigned to intelligence duties. And in some stations G-2 became a dumping ground for officers ill suited to line command.'⁷ A chief source of overseas intelligence were the reports usually routinely filed by US military attachés stationed in foreign capitals. General Eisenhower would remember that this was a 'feeble gesture'. The attachés, he said, were usually 'estimable, socially accepted gentlemen', but 'few knew the essentials of Intelligence work'. He continued: 'Results were almost completely negative and the situation was not helped by the custom of making long service as a military attaché, rather than ability, the essential qualification for appointment as head of the Intelligence Division of the War Department.'⁸ As the world turned towards war in the 1930s the US Army Air Corps was represented overseas in some capitals by assistant military attachés. One was an old-line affable and apparently affluent officer who was assistant military attaché for air in Rome from 1923 to 1927, in London from 1929-1933, and again in London in 1936-41. In July 1941, this man, Brigadier General Martin F. ('Mike') Scanlon, who had advanced in rank from a majority in 1929, became Assistant Chief of Staff, Intelligence in the new Army Air Forces.⁹

The US Army Air Corps did not have an assistant attaché in Japan; for the most part, the US Navy naval attaché represented US interests there, but an Air Corps officer went once a year from the Philippines to file a pro forma report of the order of battle of the Japanese army air forces.¹⁰ The reports of the US naval attaché in the late 1930s indicated that Japan was a second-rate aerial power, performing poorly in the war in progress in China.¹¹ On the other hand, the attaché reports from Germany filed in the 1930s by Major Truman Smith were by Smith's own account purposefully alarmist. The story has already been told about Smith's importation of Charles A. Lindbergh to awaken the American people as to the dangers posed pre-Munich by the relatively short-ranged German Luftwaffe. Smith would subsequently note that his highly alarmist air estimate of November 1937 contained omissions of basic facts: 'The most significant omission is the report's failure to state that

the Luftwaffe was not a long-range air force, built around heavy bombers with the primary mission of destroying cities and factories far behind the enemy's lines, but rather an air force designed to operate in close support of Germany's ground armies.¹²

In the immediate aftermath of the First World War US Army Air Corps theoreticians had urged that there would be a role for long-range aviation in defence of the continental United States well prior to any surface-force engagement. At the Air Corps Tactical School bombardment instructors urged a strategic bombing theory, postulating that an air assault against key economic objectives in a hostile nation would destroy an enemy's will and capability to wage war. The organisation of the GHQ Air Force in March 1935 provided a D-Day striking force.¹³ Increasing air responsibilities for D-Day readiness demanded additional autonomy for air intelligence, both for following foreign technology and for planning for air operations beyond the lines of ground contact. In the mid-1930s the War Department General Staff (WDGS) G-2 resisted any inroads into his sole authority for military intelligence; moreover, the prevailing surface strategy accepted by the War Plans Division WDGS normally involved the intelligence collection of only the strength, dispositions and projected efficiency of foreign armed forces. The US strategic war colour plans – RED, ORANGE, GREEN – envisioned Air Corps employment only in direct support of surface forces.¹⁴

In September 1939 the startling successes of the German Luftwaffe at the outbreak of the Second World War and the installation of General George C. Marshall as US Army Chief of Staff sparked a deeper appreciation of American air power, giving the US Army Air Corps a definitive mission. An influential War Department Air Board declared: 'Our aviation in peacetime, both its organization and equipment, must be designed primarily for the application of Air Power in the early days of war. The basis of Air Power is the bombardment plane.'¹⁵ At this juncture the Assistant Chief of Staff, Intelligence established a separate air section in the Military Intelligence Division (MID) to co-ordinate all aviation intelligence activities. In addition, the Air Corps Information Division had been in existence since the First World War with an intelligence section, and had been handling press relations, plus providing information on potential landing fields, aerodromes, air bases, and air routes.¹⁶ In August 1939 an Air Corps Intelligence Board proposed that

War Department intelligence responsibilities should be vested where means and facilities were available. At this juncture the War Department was only willing to agree that the Air Corps was responsible for the procurement of air material and for training, and should be therefore only responsible for 'technical' air intelligence evaluations within its province. In line with this direction, the Information Division of the Office of Chief of Air Corps (OCAC) was renamed the Intelligence Division, OCAC, in November 1940.¹⁷

The Intelligence Division OCAC nevertheless assumed a broad interpretation of what was to be considered 'technical' intelligence. It was successful in justifying the preparation of air-objective target folders, even though they were based upon economic and political values to an enemy. By June 1941, as the Army Air Forces was being established, the War Department G-2 told General Marshall that practically all phases of military intelligence were being duplicated by the Air Corps, and demanded a proper delineation of responsibilities.¹⁸ On the other hand, in July 1941 Colonel Robert C. Candee, Chief of the OCAC Intelligence Division, asserted: 'The AAF desperately needs freedom to prepare for war. Therefore, its intelligence functions should not be restricted by the views and routine channels and practices of the MID.' Brigadier General Martin Scanlon, now Assistant Chief of Air Staff (AC/AS), Intelligence, agreed: 'It is apparent,' he wrote, 'that all restrictions which tend to limit the reliability and efficiency of the Air Intelligence Division should be removed.'¹⁹ As the controversy continued the G-2 complained to General Marshall that the AAF's bid for intelligence independence presented 'a perfect picture of dual intelligence, a picture of two offices, largely duplicating each other's work and yet independent as to the results obtained - a picture of parallel lines, meeting nowhere.'²⁰ On 10 September 1941 a War Department command decision delimiting intelligence responsibilities was issued, and would remain in effect during the Second World War. It confirmed the responsibility imposed on MID for the collection, evaluation and dissemination of military information, including that which applied to the AAF as well as the other arms. AAF intelligence agencies were to be maintained to compile and evaluate technical and tactical information received from MID and other sources within the United States, plus the collection of technical air intelligence from sources abroad through co-operation with MID. All of these types of information were required by the Air Forces for

their development and for any operations the AAF might be directed to perform.²¹ General Scanlon protested against this decision to General H. H. Arnold, chief of the AAF, but General Arnold indicated that the AAF could live with the decision, as indeed was the case, since the War Department letter of 10 September 1941 remained in effect during the Second World War.²²

At the outbreak of war in Europe, President Franklin Roosevelt queried General Marshall about arrangements to get American military observers sent to the war zones, and as early as August 1940 the British Government was willing to co-operate fully in securing all categories of American military observers. A seemingly unwritten agreement between General Marshall and Sir John Dill that was accepted by President Roosevelt and Prime Minister Winston Churchill allowed a relatively free exchange of military, economic and political information. A congeries of influential Air Corps officers flocked to England, where in April 1941 a US Army Special Observers Group (SPOBS) was opened in London.²³ During the summer of 1941, Major Haywood S. Hansell, jun., went to England and met a generous welcome from the Royal Air Force intelligence establishment. Hansell sought out target materials, and on balance believed that the AAF was better informed on German electrical power, petroleum and synthetic-product resources, while the RAF knew far more about German aviation and transportation. Hansell brought back nearly a ton of classified intelligence, mostly target folders. Possession of this data was providential for the AAF when in July 1941 President Roosevelt called upon the War and Navy Departments to provide an estimate of 'the overall production requirements required to defeat our potential enemies'. To prepare the document known as Air War Plans Division No. 1, AAF planners adapted US strategic bombing concepts to predominantly British intelligence objectives. This provided a quite accurate projection of the force requirements that would be built for the AAF's wartime usage. The air planners virtually disregarded one of the fundamental precepts of military intelligence, namely that an enemy's capability to affect the performance of a desired mission should be considered in determining a course of action.²⁴ Later on, Colonel Grover C. Brown, both a bomb-group commander and a staff intelligence officer, would point out that the AAF often ignored intelligence projections of enemy capabilities. Many American airmen of the time based their plans on maximum

acceptable attrition and the range limitations of their aircraft.²⁵

In the late 1930s the US Army's Signal Intelligence Service had successfully broken the Japanese diplomatic MAGIC code and had developed 'Purple' machines for decoding messages sent in this code. The British Government Code and Cipher School at Bletchley Park solved the mystery of the top-level German ULTRA code. Anglo-American co-operation in this closely held dimension of signal intelligence was first discussed at top government levels in April 1940, and a British Security Co-ordination Office was established in New York in June 1941. On the eve of the Japanese attack at Pearl Harbor the British were operating a cryptanalysis station at Singapore, and the US Navy had a station at Corregidor in the Philippines. Also in the Philippines a small detachment of the US Army 2nd Signal Service Company intercepted and forwarded Japanese signal traffic. The Navy detachment on Corregidor had a 'Purple' machine, and could translate diplomatic traffic. The Japanese army and navy used book codes that had not been solved, but SIGINT 'traffic analysis' allowed a combination of radio direction finding and intercept radios to plot locations of especial signal emanation.²⁶

What happened in the Pacific in 1941 revealed two problems in SIGINT. During the 1930s the United States, Great Britain and Australia had been concerned with Japanese military activities in the Mandated Islands of the Central Pacific, which contrary to the League of Nations mandate had been closed to foreigners. Rear Admiral Edwin T. Layton has told the story of how US Navy intelligence assumed from signal-traffic analysis that the Japanese fleet was active in the Mandates, leading to an intelligence evaluation that if Hawaii was to be attacked the hostile fleet would sail from anchorages in the Mandates, to the southwest of Hawaii. In late 1941 General Arnold attempted unsuccessfully to secure some clandestine aerial photographs of Truk. As it happened the Japanese fleet that struck Pearl Harbor on 7 December 1941 approached from the north under strictest radio silence.²⁷ The other SIGINT problem is well known, having to do with the excessive secrecy attached to MAGIC which was one of the factors preventing an appropriate alarm from the intercepted diplomatic signal that Japan was going to war. Another intelligence failure was the widespread assumption that the Japanese were unlikely to attack Hawaii. 'Looking back on it,' remembered General Arnold, 'I am convinced now that we all assumed that the Japs would attack the Philippines. . . .

We were pretty sure that they would attack Wake and Midway when they did attack. . . . So I think that there was a general acceptance of the possibilities of Japanese aggression, certainly against the Philippines and against Wake and Midway, and possibly against Hawaii.²⁸ The success of the surprise attack thus also resulted from the intelligence analysis, which reflected supposed intentions of the enemy rather than his capabilities.

When the United States entered the Second World War it was accepted that Washington intelligence would be responsible for strategic intelligence, and that theatre intelligence agencies would handle tactical intelligence. But US Army intelligence was unprepared. Brigadier General Dwight D. Eisenhower, brought in as Chief of the WDGS War Plans Division, would remember:

Within the War Department a shocking deficiency that impeded all constructive planning existed in the field of intelligence. . . . Initially the Intelligence Division could not even develop a clear plan for its own organization nor could it classify the type of information it deemed essential in determining the purpose and capabilities of our enemies. The chief of the division could do little more than come to our planning and operating sections of the staff and in a rather pitiful way ask if there was anything he could do for us.²⁹

The intelligence debacle at the war's beginning nevertheless strangely strengthened the claim of intelligence agencies for added resources. The G-2 solution for all their problems', stated Major General Otto Nelson, a general staff organisational expert, 'was always more people and yet it was very obvious that an increase in strength was not the sole answer.'³⁰ In studies looking to the March 1942 reorganisation of the War Department into Army Ground Forces, Army Air Forces, and Services of Supply, the G-2 made a strong bid that AAF intelligence ought to be amalgamated into the Military Intelligence Service (MIS) that was being set up as the operating agency of the MID. This was not done, but the G-2 nevertheless got authority to enlarge his Air Section, and was reassured of his responsibility for collecting all intelligence both for air and ground forces. Assigned to become head of the MID in May 1942, Major General George V. Strong was credited by General Eisenhower with bringing efficiency into war intelligence in Washington. In intelligence circles Strong was hard-nosed enough to demand that

missions should be accomplished without demands for more people.³¹

In the March 1942 War Department reorganisation all AAF headquarters intelligence activities were consolidated in the Office of Assistant Chief of Air Staff (AC/AS) Intelligence (A-2). Where the personnel of the A-2 numbered 12 officers and 9 civilians in September 1941, its actual strength peaked on 1 June 1945 at 249 officers, 5 warrant officers, 296 airmen and 420 civilians. The A-2 thus became the largest of all AAF headquarters functions in Washington—this in some measure because of the assignment of miscellaneous functions such as the air-historical division and a motion-picture division. In the four war years there would be a procession of eight different A-2s, far too many to maintain a continuity in air intelligence work. Many of them had no previous experience in intelligence. Various aspects of the subordination of A-2 to G-2 continued to rankle.³² Late in 1941, for example, G-2 opposed the training of new air intelligence officers, preferring that all intelligence training remain centralised at Fort Leavenworth and at the Engineer School at Fort Belvoir, Virginia. The AAF nevertheless got authority to open its own AAF Air Intelligence School at Harrisburg, Pennsylvania. At first this school trained carefully selected directly commissioned men from civil life, including lawyers, bankers, newsmen, and the like. Before long, however, it was compelled to take run-of-the-mill graduates of AAF officer-training schools. Few of the people turned out as intelligence officers had had any aviation experience, and the curriculum at Harrisburg was highly academic.³³ In 1942 General Arnold exploded when the G-2 ruled that he could not receive reports from overseas air units not under his command except through the G-2; but here once again the AAF successfully argued that its responsibilities for equipping and training demanded that it receive reports from combat units overseas.³⁴ Early in 1942 the problem of establishing enemy air orders of battle was highlighted when a British Air Ministry delegation pointed out that it would be quite unwholesome if both the G-2 Air Section and the A-2 provided estimates of enemy air orders of battle, probably with divergences. Accordingly, the G-2 Air Section was made solely responsible for the enemy air order of battle, which in the case of Germany came from British intelligence anyway.³⁵

In the American way of war, when an army or air force was going into a theatre of operations, it was supposed to be equipped with full basic intelligence on the enemy – maps,

order of battle, terrain studies, target materials, and the like – all of which was supposed to be kept up to date in peacetime by responsible agencies in the zone of the interior. Such material was not available either in the European Theatre of Operations or in the South-west Pacific Area to arriving US Army Air Force units, who in the ETO borrowed from the Royal Air Force and in the SWPA from the Australians. In the words of probably the most knowledgeable of the air intelligence officers, George C. McDonald, 'Air Intelligence throughout the war . . . was at once an operating agency, a training school, and a proving ground – it had to be, for intelligence had to produce – if one method didn't work, another was tried, and still another if necessary, in order that requirements would be fulfilled.' As a result of the wartime experience, McDonald, who became the first Director of Intelligence in the United States Air Force, believed that air intelligence came of age. 'I may add,' said McDonald, 'that in its progress it had contributed in a major way to making Generals Carl Spaatz and George Kenney the outstanding air strategists of the United States.'³⁶

After American failures in the Philippines and the Allied débâcle in the Netherlands East Indies, General Douglas MacArthur assumed command of the Allied South-west Pacific Area (SWPA) in April 1942. Colonel Charles A. Willoughby was announced as GHQ SWPA G-2, with instructions from MacArthur to 'hit the ground running'. MacArthur lost no time asking for signal intelligence, cabling Washington that: 'Investigation discloses that a central allied signal intelligence section is required for the interception and cryptanalyzing of Japanese intelligence. The time delay and transmission uncertainties incident to sending intercepted materials to Washington and elsewhere dictate that this work be handled locally.'³⁷ Early in 1942 the remnants of the Army signal-interception unit escaped from the Philippines to Australia, and the Navy signal unit with its 'Purple' machine came southward by submarine. In his own words, Willoughby was dedicated to 'strenuous efforts to maintain and defend basic staff principles, particularly the absolute centralization of intelligence and the operational control of all GHQ intelligence activities.' At its start the GHQ G-2 Section inherited a great body of Australian data and drew on experienced Australian personnel. These resources were shaped into the Allied Geographical Section, the Allied Translator and Interpreter Section, the Central Bureau that handled signal intelligence, and the Allied Intelligence Bureau, which served coast-watchers and clandestine

guerrilla activities. In view of the Allied Intelligence Bureau, MacArthur declined an offer of the Office of Strategic Services (OSS) to come into his area, because he did not want outside intrusion.³⁸

The Allied Air Forces SWPA were established from remnants of American air units from the Philippines plus Royal Australian Air Force units. Air Commodore Joseph E. Hewitt, RAAF, was Director of Intelligence, and the Fifth Air Force chief of intelligence, soon Colonel Benjamin Cain, was Deputy Director. Early scattered air raids against better-known Japanese strong points were generally unsupported by photos or maps; but in 1942 the Japanese were moving in New Guinea overland to the last Allied foothold at Port Moresby. Even before Japanese army and navy codes were broken, signal-traffic analysis established the main patterns of Japanese air activity, the centre being located at Rabaul in New Britain. By early 1942 the US Navy could read Japanese naval codes, and for a time after January 1943, when a submarine distributing code books was captured, most naval codes could be decoded.³⁹ In the spring of 1943 Japanese army codes began to yield, and they could be broken consistently by early 1944, when a trunk of code books was captured. In July 1942 the US Army Signal Radio Intelligence Company began to arrive in Australia, and by October 1942 a major radio-intercept station capable of handling Japanese mainline traffic in volume was in place near Brisbane. By the autumn of 1942 the AAFSWPA Directorate of Intelligence included an Air Information Center that published twice-weekly intelligence summaries, a Technical Intelligence Office that handled analyses of crashed Japanese planes, a Photo Section, and a Central Interpretation Unit that provided detailed photo interpretation. The 8th Photo Squadron arrived in the autumn of 1942. Early in 1944 the AAF 1st Radio Squadron Mobile and the 1st Australian Wireless Unit joined the advanced echelon of the Fifth Air Force in New Guinea. This establishment kept a complete Japanese air order of battle with patterns of flight and airfields in use, at one time having a complete file of more than 4,000 aircraft in the Philippines and southward.⁴⁰

As is well known US Navy signal intelligence successfully predicted the Japanese seaward effort projected against Port Moresby, laying the opportunity for the Battle of the Coral Sea (May 1942). Navy signal intelligence also allowed the US Pacific Fleet to rally and defeat the Japanese at the Battle of Midway (June 1942). During and after these times Australia-based heavy

bombers flew night-time long-range strikes against Rabaul. Brisbane kept tabs on the success of these raids by monitoring Japanese radio reports reporting dwindling strengths and calling for replenishments. Thus in November 1942 reports mistakenly published revealing the highly secret radio intelligence nevertheless indicated the situation: 'Wireless intercepts reveal the Japanese Commanders at Rabaul and Kavieng have been continually calling for aircraft reinforcements.'⁴¹

In December 1942 aerial surveillance of the heaviest-ever concentration of shipping in Rabaul harbour indicated that the enemy meant to reinforce their troops at Lae and Salamaua in New Guinea. Early in January 1943 destroyers slipped underneath bad weather and landed some troops at Lae, but by the end of February SWPA G-2 had information of an impending movement of a division by sea transport to Lae and nearby Madang, with a complete schedule. Late on 28 February a convoy of seven merchant vessels and eight destroyers left Rabaul on schedule, and Allied air strikes with B-17s began on 2 March, and were followed by shorter-range attack planes on 3 March. Some 3,000 men of the 51st Infantry Division were lost at sea in this Battle of the Bismarck Sea, and this resounding victory marked the beginning of the roll-back of the Japanese in the south-west Pacific.⁴²

While MacArthur initially had considered that it would be necessary to take Rabaul, a closer study of signal and photo intelligence allowed SWPA forces to bypass this major garrison as well as other large bodies of Japanese troops. One of the outstanding examples was the quantum amphibious jump up the New Guinea coast to Hollandia, where surprise air strikes began on 30 March 1944. Intelligence had prepared the way for this assault. Intercepted signals made it evident that Hollandia was a support installation. Photo interpreters plotted the location of all Japanese aircraft. Initial pilot reports were that the Japanese pilots there were not very effective. And the Allied victory was impressive. Among other features, Japan's 6th Air Division was completely destroyed, 340 wrecked aeroplanes being counted on the Hollandia airstrips. The way back to the Philippines was open.⁴³

In the Anglo-American war strategy the defeat of the European Axis got first priority and Japan came second. In January 1942 the Combined Chiefs of Staff authorised the establishment of an American bomber command in the United Kingdom, and General Arnold promptly dispatched Brigadier General Ira C.

Eaker to England. Eaker arrived early in February 1942 and established relations with the RAF Bomber Command. Eaker's immediate entourage included Major Harris Hull and Captain Carl Norcross as intelligence officers, and for a month or more they were the only members of what would be the VIII Bomber Command intelligence staff. They were generously taken into the heart of RAF Bomber Command intelligence, and started what they described as 'the first Intelligence Section ever created for strategic daylight precision bombardment.'⁴⁴ Although the RAF served as the principal model there were differences, since the RAF was operating at night and the AAF meant to fly precision bombing missions by daylight. General Eaker would explain: 'The intelligence staffs of the groups had to be in larger numbers than that set up in the R.A.F. in order to take care of the observations of the crew members, their reports concerning the tactics employed by units of the G.A.F., the recording, evaluation, and reporting of claims and other information concerning the enemy and his capabilities, including ground activity observations, flak, smoke screens, etc.'⁴⁵

On 24 June 1942 Generals Eisenhower and Carl Spaatz arrived in England to be the US European theatre commander and commander of the US Eighth Air Force respectively. Spaatz brought with him Colonel George C. McDonald, one of a very few old-line Air Corps intelligence officers, as his chief of Eighth Air Force intelligence. McDonald would recall that no intelligence material was provided from Washington 'in any useful form at the beginning of the war - we went into the field empty handed in this respect. We borrowed the best the British had and produced the balance.'⁴⁶ In June 1942 an Eighth Air Force A-2 Liaison Office was opened in the British Air Ministry, and the American air officers assigned there not only provided normal liaison but worked integrally with their British hosts in the collection, collation and evaluation of intelligence. Except for crew reports and certain phases of photo interpretation and technical intelligence the US strategic air forces in the United Kingdom remained dependent upon British intelligence sources. Air Ministry Intelligence bore the entire burden of 'Y intercept and analysis of enemy air-traffic communications. ULTRA intelligence was closely guarded by the British, with each field command having a special liaison unit charged to reveal 'special intelligence' only to small numbers of responsible persons.'⁴⁷

In a post-war evaluation of the effect of ULTRA on strategic air operations the general conclusion was that interceptions of

high-level coded messages gave little direct information about industrial activity other than the importance of oil to the Axis war effort. On the favourable side, ULTRA and signal intelligence was vital for the knowledge it provided of the strength, disposition, composition, production, wastage and serviceability of the German air force, which was after all the major American strategic air target until April 1944.⁴⁸

In the latter part of 1942 the under-strength Eighth Air Force was stripped to create the US Twelfth Air Force for the invasion of North Africa. A few weeks after the Allied landings, the Twelfth Air Force and the RAF Eastern Air Command were joined together into the North-west African Air Force under General Spaatz. Colonel McDonald accompanied Spaatz as A-2 of the Twelfth Air Force, the successor North-west African Air Force, and then the Mediterranean Allied Air Forces. Once again in North Africa, the United States depended on the British for intelligence instruction.⁴⁹ By this time, however, the AAF Operational Intelligence Division in Washington claimed credit for some worthwhile air-objective folders, target charts, and air estimates for Italy, the Balkans and Turkey.⁵⁰ In the Mediterranean photo intelligence showed great promise, and photo intelligence facilities centred in a production establishment in Algiers were built up to a strength of some 5,000 personnel. The photo unit under operational control of A-2 operated throughout North Africa, reconnoitring as far east as Greece, covering all of Italy and part of France, and on occasions penetrating as far north as to within 50 to 75 miles of the English Channel.⁵¹

Information from ULTRA plus photo intelligence ultimately not only provided a good view of German sea-resupply activities, but enabled Allied aircraft to enforce a crippling blockade of supply to Axis forces in North Africa. Thus on 18 April 1943 ULTRA information alerted Allied fighters and made for the destruction of over half the 100 Ju-52 transport aircraft that were attempting to run the trans-Mediterranean blockade, a victory sometimes called the Palm Sunday massacre.⁵² By May 1943 McDonald was asserting that 'the type of Intelligence which has contributed most to the air, sea, and ground operational successes in the Libyan and Tunisian campaigns is Air Intelligence developed and applied by personnel who have an appreciation of air values'.⁵³

The United States Strategic Air Forces in Europe (USSTAF) was established in the United Kingdom in January 1944, with General Spaatz as commander, and Spaatz brought McDonald,

now promoted brigadier general, as the A-2. Spaatz' command was referred to as 'a glorified command post', whose functions were divided between a deputy commanding general for operations and a deputy commanding general for administration. Directly under the deputy for operations were the director of operations and the director for intelligence. Spaatz wanted a close integration of intelligence and operations. Everything of a public-relations nature and of counterintelligence and security was completely divorced from the directorate of intelligence, with press relations emerging as a special staff section and counterintelligence and security being placed under the deputy for administration. McDonald observed: 'This permits Air Combat Intelligence to work full out, devote entire time to that activity, and seriously get on with the war.' He continued: 'I look upon Public Relations Office and all other activities that in times gone by have been thrown into A-2, as a type of fungus growth which tends to smother the real job of getting on with the Air Combat Intelligence in developing and in turn properly servicing the Commanding General and his staff. Our experience in Africa along this line has confirmed the wisdom of that type of organization.'⁵⁴

During the spring of 1944 the US Strategic Air Forces in Europe continued to get the bulk of their intelligence from the Air Ministry. The two pressing air missions preparatory to the Normandy invasion were to neutralise the Luftwaffe and to interdict enemy surface transportation to the invasion coast. ULTRA and signal intelligence provided a valuable means for projecting the Luftwaffe air order of battle, but apparently because of the distances involved ULTRA interceptions from the eastern front were difficult to manage. On occasion German air units serials showed up on the Russian front for which there was no previous record. In one effort to extend signal coverage deep into Germany the Eighth Air Force in the spring of 1944 began airborne 'Y' operations. McDonald stated: "'Y' has outgrown its original status as a by-product of Signals and today deserves recognition as one of the major sources of Air Intelligence.'⁵⁵ It would appear that ongoing intelligence afforded General Spaatz a fairly accurate means of determining how well his air missions were being performed. Signal intelligence allowed A-2 to establish the serviceability, fighting value, and projected capabilities of the Luftwaffe, and to discount more imposing strengths based upon supposedly assigned initial equipment of units.⁵⁶

Already familiar with ULTRA in North Africa, Lieutenant-General Elwood R. ('Pete') Quesada witnessed more of the advantages of signal intelligence in Europe, where he commanded the US IX Tactical Air Command. Quesada recalled: 'One of the best sources of information was "ULTRA", which often gave us advance warning of German plans. This frequently gave us a more accurate knowledge of what was happening to the Germans than Hitler had.'⁵⁷ But once the Allies were approaching Germany, the Germans could use secure landline communications in preference to radio, and ULTRA was of reduced value. In September 1944 the Allied 'Market-Garden' airborne invasion at Arnhem turned out badly because the presence of German Panzer forces within striking distance had remained unrevealed by signal intelligence. Dutch resistance fighters got word of the danger to the Allies, but Field Marshal Bernard Montgomery is said to have shrugged off the threat, allegedly because he doubted the enemy's intentions to intervene. In a post-war comment, Lieutenant-General Lewis Brereton, commander of the First Allied Airborne Army, said the intelligence for Market-Garden was 'very bad'. He said that it was 'collected by Army units primarily for use on their own immediate front. It was inadequate for airborne operations because it did not give knowledge of enemy forces in the objective area well in rear of the main battle lines.'⁵⁸ In the case of the Ardennes offensive of December 1944 the Germans launched this massive assault from within the security of their own lines.⁵⁹

In Washington well into 1943 the main thrust of the Office of AC/AS Intelligence was to get air intelligence freed from the War Department Military Intelligence Division. Shortly after taking over as AC/AS Intelligence in November 1943, Major General Clayton Bissell discussed these often-recurring proposals that AAF intelligence ought to have an organisation entirely independent of the War Department G-2. General Arnold and Assistant Secretary for Air Robert A. Lovett said that this was unacceptable to General Marshall, who considered that any defects in the service which G-2 was providing to the AAF ought to be brought out and corrected. Two visits to Europe led Bissell to believe that air intelligence was satisfactory, but he was less pleased with the multiplicity of United Nations intelligence activities in the Pacific. He did not believe that the necessary advanced planning and organisation that would be needed for eventual all-out operations against Japan were in effect. In

February 1944 General Strong was retiring, and General Marshall selected Bissell to be Assistant Chief of Staff, G-2. Marshall let it be known that both G-2 and the AAF were under his control, and he wanted any difficulties corrected, which could be done most feasibly by a man whose background reached far back into the early days of the Air Corps.⁶⁰ When Strong was briefing Bissell about the functions of G-2, Bissell asked whether there was some agreement that the British would be responsible for intelligence in Europe and that the United States was to be responsible for intelligence in the Pacific. Strong eventually remembered that, as of mid-1943, and he believed earlier, there was an 'accepted idea that Europe, North Africa and India, including the Middle East, are a British sphere and that the Pacific, including China, Indo-China, Netherlands East Indies, and Australia is an American theater.'⁶¹

As a part of a major effort to improve the War Department intelligence organisation, a board of officers headed by Assistant Secretary of War John J. McCloy was appointed to study and recommend organisational changes. This board came to believe that 'the grinding out of military intelligence was not dissimilar to the job of publishing a large newspaper or news magazine'. Its recommendations culminated in a radical revision of the Military Intelligence Service in June 1944, whereby it was divided into three major directorates: Administration, Information, and Intelligence. Arrangements were made whereby ULTRA and MAGIC (now collectively called ULTRA) would no longer be compartmented in a 'Special Branch', but would be fused into other intelligence.⁶² Meanwhile on 24 February 1944 an Anglo-American agreement was formally drafted and agreed whereby primary responsibility for co-ordination of all aviation-intelligence activities in regard to the German air force would be centred in London, with American intelligence personnel augmenting the existing Air Ministry organisation. Primary co-ordination of all aviation intelligence pertaining to the Japanese air forces would be centred in Washington, with British augmentation, mirroring the arrangement in London.⁶³ In April 1944 an *ad hoc* committee, chaired by Colonel W. M. Burgess, stressed a need for a single properly constituted agency for the allocation of priorities for attack against air targets in Japan. 'At present,' the committee noted, 'there is no single properly constituted agency for the allocation of priorities of targets or targets systems.'⁶⁴

In his administration as War Department G-2, General Bissell

stated that air intelligence in the Pacific must be handled on a joint Army, Navy, Air Ministry basis. 'Agencies concerned,' he wrote, 'are taking over primary responsibility for activities which they are best able to handle, being assisted in the implementation of their responsibilities by appropriate officers from Navy Air, Army Air, G-2, or Air Ministry.' A first fruit of the co-operative policy was the establishment by the Secretary of the Navy of the Technical Air Intelligence Center (TAIC) at the Naval Air Station, Anacostia, DC, and the attachment to it of the AAF A-2's Technical Air Intelligence Division under Lieutenant-Colonel Frank T. McCoy, one of the AAF's most experienced men on Japanese equipment, who was brought back from Australia to become the AAF senior representative.⁶⁵ The new policies somewhat concerned General McDonald in London, especially an erroneous interpretation issued that the US Navy was becoming responsible for air intelligence in the Pacific. McDonald sent a copy of the confused RAF instruction to Washington with a note that 'General Spaatz was keenly interested.' McDonald added: 'General Spaatz duly recognizes that the foundation for successful air force operations is air intelligence, and we must have a high degree of adequate air intelligence before the planners can plan and before the operations people can carry out the plans that have been outlined, following which the air intelligence is again responsible for assessing results of the operations in enemy areas.'⁶⁶ McDonald was somewhat mollified when he was assured that the Navy would not be responsible for air intelligence in the Pacific; but he nevertheless elicited comments once again from General Spaatz, this time to the effect that 'there are fundamental differences between Air, Ground, and Naval Intelligence and they should be headed by their own experts, with integration at the highest level. In fact, Air Intelligence is a greater specialty than Naval Intelligence and there is no more reason why it should be integrated in the Army than Naval Intelligence should be similarly integrated.'⁶⁷

Negotiations for establishing a joint agency to handle allocation of Japanese air targets went slowly through the middle months of 1944. In an April report to the Joint Intelligence Committee the *ad hoc* committee stressed a need that such a target agency should be able to determine the prospective physical vulnerability of a target as well as its intrinsic importance, this even though the committee noted that physical vulnerability was 'not strictly an intelligence function'. Further study by

the Joint Intelligence Committee propounded recommendations to the Joint Chiefs of Staff that were noted and approved without discussion on 2 August 1944. The JCS directive notably provided for co-operation between the Army, the Navy and British intelligence for air targeting rather than any integration of existing establishments. The Joint Chiefs nevertheless called for establishment of a joint target-analysis group to be headed by a brigadier general under the AC/AS Intelligence, who would ask other services for participation. On 11 September the Army Air Forces directed the establishment of this agency, which would shortly be called the Joint Target Group.⁶⁸

Where General Bissell had hoped to get a vitalisation of War Department intelligence, the Air Force intelligence establishment did not show immediate response. It was the largest of the AAF Headquarters staff activities, and the incumbent A-2, Brigadier General Thomas D. White, could not get modification of the fixed personnel ceilings in effect in Washington unless other staff agencies were willing to give up people. On 2 September, moreover, General White was suddenly transferred to a combat command in the south-west Pacific, and was replaced by Major General James P. Hodges, an outstanding air officer who had no intelligence experience. Even though the Joint Target Group had begun to function with additional duty personnel, Hodges soon described it as 'inchoate'.⁶⁹ Finally, on 17 November 1944, Brigadier General John A. Samford arrived from England and was announced as Deputy AC/AS Intelligence for Targets and director of the Joint Target Group. The Director of Navy Intelligence named the deputy director, and together the AAF and Navy provided the lion's share of assigned personnel. There were, however, members from the OSS, Foreign Economic Administration, Office of Scientific Research and Development, and Chemical Warfare Service, and a single Royal Air Force liaison representative. The JTC charter of 6 December empowered it to prepare, produce, and distribute air-target lists, target information and objective folders, and to prepare damage-assessment reports following attacks against priority targets, to include physical damage effected and probable effects on production.⁷⁰

During 1944 tediously evolving organisational changes in the Office of AC/AS Intelligence brought the top-level AAF intelligence set-up roughly into the same configuration adopted by the War Department G-2, the announced purpose being to make more efficient use of a limited amount of intelligence expertise

relative to Japan. A top-level Plans and Policy Staff provided guidance, served higher Joint and Combined Chiefs of Staff intelligence inputs, gave administrative support to air intelligence, and supervised air-intelligence recruitment and training. Like the G-2 organisation a Collection Division and an Analysis Division were established. The Technical Air Intelligence (Japanese) Division manned the AAF share of the Anacostia project, and the Joint Target Group was an air-intelligence responsibility. There was also a Counterintelligence Division, a Photographic Division, a Motion Picture Division, and a Historical Division, the latter two activities being considered to be incongruous with the intelligence mission.⁷¹

During 1944 the AAF also confronted the fact that its hurriedly improvised AAF Air Intelligence School at Harrisburg, Pennsylvania, had put into service some 10,000 intelligence officers with no particular expertise in air or military matters. 'As you know,' General Hodges would recall, 'we had to do a rush job of turning bankers and insurance salesmen into combat air intelligence officers.' Very few Harrisburg graduates had any military training, and many had never flown in an aeroplane. Most had been trained as specialists, frequently in photographic interpretation. In order to provide something more than purely academic training, the AAFAIS was closed in March 1944, and an Intelligence Department at the AAF School of Applied Tactics in Orlando, Florida, was opened. The courses at Orlando emphasised practical training. As a basic objective, General Hodges announced his intention to build a sound intelligence corps, including regular officers assigned to intelligence duties. He wanted air intelligence to be able to 'walk upon its own feet' and to be able to muster a capable post-war career field. Accordingly, staff intelligence officers were rotated to Orlando for refresher training, and in Europe USSTAF intelligence was instructed to assign as many regular officers as possible to service with Air Ministry intelligence, to learn as much as they could from the British.⁷²

Despite the announced intention to provide air intelligence devoted to Japan on a scale equivalent to that of what the British had provided against Germany, the American effort faltered. Thus in June 1945 Assistant Secretary Lovett was concerned that 'we may find ourselves in a position of supplying much less valuable data to our forces against the Japanese, than we did against the Germans, because we shall not have the British collecting agencies and vast intelligence organizations to fall

back upon.' A response on 6 July signed by Deputy AAF Commander Lieutenant-General Ira C. Eaker but written by Lieutenant-Colonel James T. Lowe of the Air Intelligence Plans and Policy Staff, acknowledged that US intelligence relative to Japan was not and probably would not be as good as that furnished against Germany. Air intelligence against Germany had benefited from centralisation in the Air Ministry, from the short distances to the enemy nation, and by the fact that raw information could be received, evaluated and disseminated in a matter of hours. The sources of information in Europe were also much better both before and during the war than they had been or could be against Japan. 'All in all,' the letter read, 'because of the factors of organization, decentralization of authority, division of responsibility, lack of source control, time and distance, the air intelligence we are supplying to our forces against the Japanese is probably less valuable than that we supplied against the Germans.'⁷³

The record of the Joint Target Group in the last months of the war against Japan illustrated the deficit in intelligence. After beginning work in December 1944 the JTD listed some 500 most important industrial targets in the Japanese home islands. The initial strategic air targets were held to be aircraft-manufacturing facilities; but these attacks were judged, erroneously it turned out, not to be very effective because of the difficulty in bombing from high daylight altitudes through difficult air currents. After a first urban fire-bomb blitz, the Joint Target Group concluded that, while there were no strategic bottlenecks in Japan's systems other than aircraft-engine plants, the enemy's industry as a whole was vulnerable through incendiary attacks on cities. The JTG then proceeded to list, in order of priority, the twenty-two most vital Japanese cities from the standpoint of the industries they contained. 'The Joint Target Group,' wrote Major General Haywood S. Hansell, jun., who as XXI Bomber Command commander had been committed to precision bombardment against precise targets, 'simply embraced a new tactic that was both easier to perform and to measure.'⁷⁴

In 1944 General McDonald believed that air intelligence had come of age in both Europe and the Pacific; but it appears that much of this experience was either soon forgotten or not considered relevant to air warfare with absolute weapons. With nuclear bombs, whole cities could be destroyed, making it unnecessary laboriously to target specific objectives. Some target-planners were surprised when the thought hit them:

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When the war in Europe was over, General Spaatz asked McDonald to prepare a report for historical purposes on the effect of ULTRA on strategic air attack versus the German air force. The name 'ULTRA' was not even supposed to be mentioned, much less to have a history of it written. Nevertheless the history Spaatz wanted was prepared by a talented writer, Lieutenant-Colonel William W. Haines; but once written it was promptly impounded by the intelligence establishment. As a result, this valuable account, showing the intimate relationship between intelligence about the German air force and strategic bombing, was not released by the US National Security Agency until 1978.⁷⁷ Thus a full knowledge of air intelligence was not available even in limited circles in the new United States Air Force. This was disadvantageous to a needed development of military professionalism.

Notes

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77. Putney, *ULTRA and the AAF* pp. 60-1: [National Security Agency] 'ULTRA History of U.S. Strategic Air Force Europe vs. German Air Force', in AU Library File M-U-43294-8. This history was printed by University Publications around 1980, as stated in note 48 above.

The Sources and Organisation of RAF Intelligence and Its Influence on Operations

Sebastian Cox

The aim of this chapter is to sketch out the sources and organisation of intelligence in the Air Intelligence Branch of the RAF, and then consider briefly the impact and use of such intelligence on operations. It will not consider the intelligence work of other agencies, such as the Government Code and Cypher School (GC & CS) and the Ministry of Economic Warfare, or the appreciations of bodies such as the Joint Intelligence Committee or the Chiefs of Staff, except in so far as they contributed directly to, or conflicted with, RAF intelligence.

At the outbreak of war the Air Intelligence Branch of the Air Ministry had a staff of some forty officers, approximately half of whom were regular serving personnel, and half re-employed retired officers; many, for some reason, were Army officers. The organisation was headed by a serving Group Captain as Director of Intelligence, who was in turn supported by three Deputy Directors and an Assistant Director. The first Deputy Directorate (DDI1) dealt with liaison with the Secret Intelligence Service, MI5, foreign attachés, wireless intelligence, and air photography, with the last two coming under the Assistant Director. The second and third Deputy Directorates, DDI2 and DDI3, were organised on a geographical basis, one dealing with Europe, and the other covering the rest of the world, including the Soviet Union, the USA and the Middle and Far Eastern countries. Within DDI2 and DDI3 subsections dealt with a particular country or group of countries, and were responsible for collecting, collating and interpreting all material relating to that area. Thus AI3(b) dealt with every aspect of air intelligence relating to Germany, including order-of-battle intelligence, aircraft, airfields, training, production, etc.

This geographically-based structure was well suited to peacetime requirements, where the origin of intelligence material, whether from open or clandestine sources, tended to relate to one particular country, and where, similarly, assessments were seldom required for more than one country at a time. For the first eight months of the war the geostrategic situation remained relatively unchanged, and there was therefore only one immediate enemy to face, and the pre-war organisation with one specialist and two geographical directorates continued to function satisfactorily.

However, the German offensive in the west, coupled with the entry of Italy into the war, altered the situation radically. The immediate crisis of the Battle of Britain was obviously an inopportune moment for change, but once the imminent threat of invasion receded, a long period of reorganisation and readjustment followed between November 1940 and August 1941. The *de facto* disappearance of national frontiers, and the increasing need to deal effectively with operational intelligence of the utmost urgency, soon led to the abandonment of geographical divisions in the handling of intelligence in the war against Germany. It was also recognised at an early stage that, despite their apparent alliance, the two hostile Axis powers were in effect waging two separate wars with Britain. The first reorganisation therefore created four Deputy Directorates, one to deal with Germany and occupied Europe; one to deal with Italy, the Balkans and the Middle East; one to deal with neutral countries; and DDI1 to continue its liaison function. At the same time DDI3, which dealt with northern Europe, began to reorganise its sections to deal with specific subjects, rather than geographical areas. AI3(b), for example, was now given the task of studying the order of battle and organisation of all the air forces within its area, instead of, as before, covering every aspect of air intelligence for Germany alone. At this stage, that is late 1940, this functional basis was limited to DDI3.

Further reorganisation at various times during 1941 saw a gradual increase in this functional specialisation, and in the summer of 1941, with the entry of the Soviet Union into the war, the whole of the Air Intelligence organisation was altered to this basis. The outcome was a rearrangement of sections which eventually resulted, broadly speaking, in DDI2 becoming responsible for all information on technical subjects, airfields and the administration of industries in foreign countries, whilst DDI3 handled orders of battle, air operations by foreign air

forces, target material, reserves and training. DDI4 now became a Deputy Directorate solely devoted to signals intelligence, which reflected its greatly increased importance. In addition new assistant directorates were created to deal with photographic and scientific intelligence, the latter of course being personified in Professor Jones. The whole organisation was itself enhanced by the appointment of an Air Vice-Marshal as Assistant Chief of the Air Staff (Intelligence), with overall responsibility for all Air Ministry intelligence, and three Directors respectively of Operations, Security, and Foreign Liaison, each in the rank of Air Commodore. This basic organisation survived until 1945, with new directorates being formed or disbanded as the occasion demanded. The small band of some 40 officers in Air Intelligence in 1939 had, however, expanded to more than 700 officers by the war's end, and one of the strengths of the Air Intelligence organisation, as of Bletchley Park, was its ability to attract high-quality personnel from civilian life, so that by May 1945 only ten officers, all in the rank of Group Captain or above, were regular RAF officers.

If, however, the successive reorganisations of intelligence between November 1940 and the summer of 1941 were a result of the changing nature of the war as German successes altered the map of Europe, and of the increasing need for operational intelligence as the RAF's active involvement in the war became a reality, they were also a reflection of the shift in the relative importance of intelligence sources. Before the war much intelligence had come from both open and clandestine sources within the Axis Powers, and from friendly intelligence services, and had tended to focus on overall strength and production matters. The co-operation of friendly intelligence services ceased in mid-1940, and while some clandestine sources remained in Germany open sources were abruptly cut off with the outbreak of war.

The most valuable sources of intelligence in war were to be signals intelligence, or 'sigint', and photographic reconnaissance, or 'PR'. These were supplemented by various other sources, including POW interrogation, agents' reports, reports from air attachés in neutral countries, the German press, and so on. Ironically the central importance of the two major sources had not been foreseen before the war. Though some progress had been made with the interception, or 'Y', service, photographic reconnaissance was considered almost exclusively in terms of tactical reconnaissance in co-operation with the Army -

an activity which did not figure prominently in the RAF's pre-war planning.

Taking sigint first, this consisted of the interception and interpretation of four main types of signals traffic: high-grade cyphers encrypted on the famous Enigma machine, low-grade wireless telegraphy (W/T) traffic, usually to and from aircraft, low-grade radio-telephone traffic, and other signals traffic such as navigational beams and beacons, or radar transmissions. Before the outbreak of war the RAF had set up an interception system consisting of one main and four subsidiary stations, and these had been intercepting and interpreting low-grade German W/T traffic since 1935. Luftwaffe signals security was relatively poor, and German bomber and transport aircraft used their unit markings as W/T call-signs before the war, enabling RAF Intelligence to build up a reasonably accurate picture of German Air Force numbers. On the outbreak of war the system was changed, but the knowledge of units and airfields already built up by Air Intelligence meant that by the end of 1939 most operational units had been re-identified. In this way some German long-range bomber units were followed on their return to their normal German airfields after the Polish campaign. At the beginning of the war sigint in the Air Intelligence Branch had been handled by one small subsection with a Squadron Leader and a Flight Lieutenant. The massive expansion in the sigint organisation, and the immense contribution of the Government Code and Cypher School, are of course well known.¹

Very much less pre-war attention was paid to photographic intelligence, which was the responsibility of a single Squadron Leader in Air Intelligence in 1939. There was little pressure within the Service for any improvement in PR, with the notable exceptions of the pre-war C.s-in-C. of Bomber Command, Air Chief Marshal Sir John Steel, and Air Chief Marshal Sir Edgar Ludlow-Hewitt. The latter, with remarkable prescience, was pressing as early as 1937 for a fast twin-engined aircraft for the purpose of strategic photo-reconnaissance, which he believed would be essential for the proper conduct of a bomber offensive. He stated that such an aircraft could also be used as a fast light bomber aircraft for 'harassing' bombing. What he was referring to eventually came into being as the Mosquito, and his influence in the genesis of that remarkable aircraft has yet to be fully recognised. The RAF as a whole, however, still regarded PR as a task which could be performed by any competent airman, flying

ordinary service aircraft fitted with cameras. The years of economy before the war had reinforced the view that specialised aircraft and specialised airmen were a luxury which could not be afforded. Whilst there was belated recognition in the immediate pre-war years of the need for photo-reconnaissance back-up for Bomber Command, it was still thought of in terms of an additional duty for established bomber and maritime squadrons. In addition, because of a long-standing agreement between the RAF and the Army which dated back to the First World War, photographic interpretation was solely an Army responsibility. Thus, until the RAF unilaterally abandoned the arrangement in February 1938, there were neither interpreters, nor interpreting equipment available.²

The harsh lessons of war very quickly exposed the shortcomings of pre-war policy. Of the first 48 reconnaissance missions flown by Bomber Command no less than 8 were shot down: a casualty rate of just over 16 per cent was plainly unsupportable. Even those sorties which returned frequently produced little or nothing of value. The attempts of the Air Component of the BEF to obtain PR cover for the Army in France were even more costly, the casualty rate approaching 20 per cent. In addition, 60 per cent of the sorties which returned came back with neither photographs nor intelligence.³ The pioneering work of the maverick Sydney Cotton, whose free-lance activities with the Secret Intelligence Service had proved so successful before the war, now came to the fore. Faced with so desperate a situation the Air Staff co-opted Cotton into the RAF, and the future basis of PR, i.e. the reliance on unarmed high-speed aircraft, was established. Cotton's small experimental unit at Heston was provided with two Spitfires at the end of October, and in its first two months it flew fifteen sorties, two-thirds of which were successful, without loss.⁴ It is perhaps instructive, as an illustration of the novelty of this arrangement and the opposition it engendered, to quote Sir Hugh Dowding's reaction in a signal he sent to the Air Ministry: 'Earnestly request that my Spitfire resources may not be treasured for any purpose whatever other than home defence fighting.'⁵ He was informed that the transfer had been approved personally by the Chief of the Air Staff. The subsequent technical improvements in aircraft and cameras are largely outside the scope of this chapter; suffice it to say that they took some time to reach fruition.

Of greater relevance are the developments which occurred in photographic interpretation.⁶ The arrangement with the Army

which has already been mentioned meant that the RAF had no officers trained in this exacting art. During the period of heightened tension with Italy in the mid-1930s it was thought prudent to conduct photographic reconnaissance missions in the Mediterranean and the Red Sea, but the photographs had to be returned to the UK for interpretation by Army officers, despite the fact that their primary purpose was not tactical, but strategic, intelligence. The RAF was therefore in the humiliating position of relying on the goodwill of the Army for the interpretation of photographs taken by its own squadrons to establish the existence of possible Italian air and naval bases. In March 1938 the first RAF officer with responsibility for air-photographic intelligence was established in the Air Ministry Intelligence Branch, and it was this section, AI1(h) which interpreted the clandestine photographs taken by Sydney Cotton for the SIS. At about the same time the first four officers to be trained in photographic interpretation attended a two-week course at the RAF School of Photography. All four were intelligence officers with Bomber Command, and it was at Bomber Command that a parallel organisation to AI1(h), the Command Photographic Interpretation Section grew up. In fact the Bomber Command section took a wider view of the function of interpretation than its Air Ministry counterpart. It did not restrict itself to serving the needs of Bomber Command, but passed general information of intelligence interest to other Commands and to the Admiralty. A third centre of interpretation was also developing at this time in the shape of a private company which had specialised before the war in aerial survey work. The company had both skilled interpreters and sophisticated equipment, neither of which were available to the Air Ministry or Bomber Command. The company was eventually contracted to interpret for the RAF, and unsurprisingly proved itself in many ways superior to the existing organisations. Eventually it was absorbed into the RAF's own Interpretation Unit, although it would perhaps be more accurate to say that in effect the company became the Photographic Interpretation Unit and absorbed AI1(h), and eventually much of the Bomber Command Interpretation Section as well.

The gradual amalgamation and reorganisation of the various centres of interpretation, which had sprung up to meet immediate and pressing needs, was accompanied by a reorganisation of the PR units themselves. Both Bomber Command and Coastal Command had established photo-recce units, partly in an at-

tempt to ensure that their own needs were given priority. In June 1940 all the PR units in the UK were put under Coastal Command, but the sole authority for requesting PR cover was vested first in the Combined Intelligence Committee, and then passed to a Joint Photographic Reconnaissance Committee. The joint PR committee was an inter-Allied, inter-service organisation which met twice a day and arranged the bids for PR sorties in order of priority.⁷

Once the sortie had been flown successfully the initial interpretation was undertaken by an Interpretation Officer at the airfield, who ordered rapid production of selected prints. These were despatched with the entire film to the Central Interpretation Unit (CIU), where a second-phase interpretation took place. The first-phase interpretation made from the rush prints was usually available within two hours of the aircraft's landing, and urgent information was often telephoned to recipients within one and a half hours of landing. Second-phase interpretation of the whole film was issued by the CIU within 48 hours. Third-phase interpretation, which was usually done by specialist sections, took much longer, and non-urgent reports might be issued several weeks after the sortie. In certain instances, however, as in the case of reports on oil-plant activity in 1945, the third-phase report could be produced before the second-phase one. The function of the second-phase report was to comment on enemy activity in considerable detail before the information ceased to be of value. In other words it tended to be of an operational nature. By the end of the war some of this information was collated in daily Airfield, Shipping and Railway reports.⁸

Having considered the organisation and some of the sources of intelligence it is perhaps appropriate at this point to consider in more detail some of the specialised areas which Air Intelligence studied, and airfields are perhaps a prime example.⁹ Early in the war airfields had been dealt with by the various geographical sections, and the inadequate coverage which resulted is an illustration of the shortcomings of the 'national' approach to intelligence. There was no agreed definition of what actually constituted an airfield, nor was there any agreement on where to draw the line between suspected and confirmed airfields, with the result that one section had five times the true number of airfields listed for its area. At the end of 1941 airfields became the responsibility of AI2(b), and by the end of the war there were 37 officers working in this section alone. They utilised four

major sources in compiling intelligence on enemy aerodromes: photo-reconnaissance, sigint, SIS agents' reports, and POWs. Of these PR was incomparably the most important, revealing as it did not only the location of the airfields, but also details of facilities, runways, dispersals, etc., and a record of development and construction work which frequently portended operationally important changes. Agents' reports were useful in confirming the existence of the less obvious airfields, and in helping to establish the layout, the facilities, and on occasion the units deployed. This source was, of course, much more active in the occupied territories, where one agent for example worked for the Germans building the airfield whilst simultaneously supplying a full set of plans to Allied intelligence. Both sigint and POW interrogation were prime sources for establishing which units were at a particular airfield, with the latter often confirming the intelligence provided by the former.

AI2(b) produced numerous special reports as well as regular lists and maps. By 1944 the section was producing the following regular appreciations:

1. Daily Airfield Interpretation Signal;
2. Bi-Weekly Activity Reports;
3. Airfield Target Priority List; and
4. Airfield Occupation List.

The purposes of these are mostly self-evident. The Daily Airfield Interpretation Signal is particularly interesting, however, because of the role it was designed to fulfil. It was introduced in April 1944 in preparation for Overlord, and its purpose was to provide up-to-the-minute airfield intelligence to keep pace with rapid changes in the tactical situation. It consisted of a nightly signal containing a digest for the previous 24 hours, giving a general estimate of airfield activity, serviceability, development and repair work, and intelligence on newly-discovered landing grounds. An example of the value of this information is provided by an incident in the winter of 1944-5. Few Luftwaffe airfields were provided with concrete runways, and at one time the Daily Interpretation report estimated that 80 per cent were unserviceable because of the weather. This enabled the 8th Air Force to redeploy some 200 fighters from escort duties to ground-attack missions.

The Luftwaffe's ground organisation also proved a fruitful field for intelligence, and the detailed knowledge built up by

AI3(e) in this area provided a valuable source of intelligence on German intentions. In many cases the warning provided by the transfer of the Luftwaffe's ground units came far in advance of that given by the moves of operational units. The first to arrive were usually the signals units, who immediately set about providing the communications links essential to the proper functioning of the operational units. These were, of course, the very links which produced so much of the traffic intercepted and decoded by Bletchley Park. In the course of time AI3(e) accumulated considerable expertise in assessing the gradual build-up of ground units, and was able to predict fairly accurately the lapse of time before air forces of a given strength could be operational in a new area.

The largest section in Air Intelligence was AI3(b), which was charged with studying the order of battle, strength, disposition and operations of the hostile air forces. The section was further divided into three subsections, dealing with Operations; Order of Battle, Strength and Dispositions; and Losses and Replacement Rates. The greater part of the manpower was devoted to studying the operational activity of the Luftwaffe, and daily estimates were produced on the scale of enemy effort the previous day, and the units and bases involved. In addition there was a weekly appreciation, 'The German Air Force on the Western Front and in Germany and Austria', which was distributed to the Air Staff and all Commands and operational stations in the UK, and later in the war to all Commands on the western front. The subsection dealing with Order of Battle intelligence kept track of all operational units, and again a weekly commentary 'The Disposition of the German Air Force' was distributed to the Air Staff, and all Commands at home and overseas. A complete German Air Force Order of Battle, unit by unit, was published approximately every three months, and given wide distribution to all units and stations. The subject of Luftwaffe loss and replacement is dealt with below.

The organisation, sources and products of any intelligence system are not the crux of the matter, however. The essential consideration is the effect such intelligence had on the conduct of operations. Obviously there is only limited scope for such a review, so the rest of this chapter will be devoted to analysing Fighter Command's use of intelligence up to the end of 1942, and the relationship of intelligence to aspects of the bomber offensive from 1940 to 1945.

The operations of Fighter Command during the first eight months of the war hold little interest for the historian of intelligence, because German Air Force activity against the United Kingdom remained at a relatively low level. During the Battle of France Fighter Command became heavily involved, but there is little evidence that intelligence was of prime importance to its conduct of operations, other than in the general sense of helping to confirm the swiftness of the French collapse, and therefore bolstering British determination to resist the transfer of further fighter forces to France. The first indications of the expected air offensive against Britain came from photographic evidence of the extension of French airfield runways, and low-grade sigint indicating the arrival of Luftwaffe bomber units in northern France. From the end of June Enigma intelligence on the improved states of serviceability and readiness in German bomber units and the arrival of dive-bombers on airfields across the English Channel indicated that the period of grace whilst the Luftwaffe rested and refitted after the French Campaign was nearly at an end.¹⁰

Once the Battle of Britain started, which in British eyes means from early July, intelligence contributed in two major areas. Firstly in the provision of order of battle and organisational intelligence on the Luftwaffe, and secondly in more direct and immediate intelligence on Luftwaffe operations. Both types of intelligence relied heavily on sigint. The increasing amount of traffic in late June from the Luftwaffe's operational units had enabled AI to build on its earlier work in this field, and with its increasing understanding of the organisation and equipment of the German Air Force it made a very significant adjustment in its estimate of German strength. In June the Air Ministry estimated that the Luftwaffe disposed of 5,000 front-line aircraft, including 2,500 bombers, backed up by 7,000 in reserve, when the actual figures were approximately 2,000 and 1,000 respectively. In the face of open incredulity on the part of Professor Lindemann, Churchill's scientific adviser, and increasing contradictory evidence from sigint, AI scaled these figures down and suggested that only 1,250 bombers would be available in the front line at the start of the campaign. The Air Staff were, not surprisingly, very much relieved at the revision, which, because of its source, was described as 'apparently sure'. Nevertheless, the tendency was still to over-estimate German strength, both front-line and reserve, and thus to ascribe greater staying power to the Luftwaffe than was actually the case, even though Fighter Com-

mand was claiming a success-rate two to three times the true scale of German loss. There were further disputes between Professor Lindemann, the Prime Minister, and AI throughout 1940, which culminated in the appointment of a distinguished judge to adjudicate on the matter. His conclusions supported Lindemann, and not AI.

It is probably true to say, however, that these errors and disputes did not affect Dowding's strategy, except, perhaps, in confirming him in his conviction of the correctness of the essential core of that strategy, namely, maximum conservation of his meagre resources. So far as intelligence which did have a direct effect goes, the picture is far less clear. The Official History of Intelligence states categorically that 'the Enigma was of no help in forecasting the shifts that occurred during the Battle in the GAF's methods and objectives'.¹¹ This is a perfectly sound conclusion: the reason being that the major Luftwaffe headquarters and High Command in Berlin were all linked by landline, and major strategic decisions were seldom transmitted by wireless. Thus, shifts in German strategy during the battle had to be deduced by Dowding and Group Commanders purely from close observation of the Luftwaffe's operations. Occasional clues, such as odd references to *Adler Tag*, were too vague to indicate anything of value.

On a tactical level, however, the Official History's view that Enigma gave very little assistance is perhaps less convincing. I quote again:

In the day-to-day fighting, by giving notice of the time, the targets and the forces committed to individual raids, the Enigma provided an increasing amount of intelligence as the GAF (German Air Force) moved into its all-out effort. But this intelligence was sometimes obtained too late to be of operational value. Moreover, the GAF made last-minute alterations of plan which were not disclosed in the decrypts, or were not disclosed in good time.¹²

This is true so far as it goes, and is perhaps a necessary corrective to the 'Ultra won the Battle of Britain' school of thought. There is, however, at least some evidence that the Official Historians' conclusion that Fighter Command received no advanced warning of the attacks on the north of England by Luftflotte 5 on 15 August 1940 may be in error. The defeat of Luftflotte 5, and the heavy losses incurred by the Bf 110 fighters flying from Scandinavia, was a decisive moment in the battle,

confirming as it did the inferiority of the Bf 110 and the fact that Fighter Command could not be outflanked. The eminent British historian Ronald Lewin states categorically, on the basis both of Enigma decrypts in the Public Record Office and of information from Group Captain Winterbotham, that Dowding knew, not only that Luftflotte 5 was to intervene that day, but also that the German plan involved a series of seven raids widely spaced both geographically and chronologically.¹³ Thus, while the Official Historians may be right in playing down the influence of Enigma decrypts during the battle, with regard to the decisive events of 15 August there may be grounds for believing that they are uncharacteristically wide of the mark.

If the influence of high-grade sigint is thus a matter for some contention, there is greater agreement concerning the immense value of low-grade medium- and high-frequency W/T traffic. The RAF wireless interception service centred at Cheadle already had much experience of intercepting German W/T traffic, and they were able to put this to good use. The medium-frequency traffic of the German air-traffic control service gave early warning of the departure of aircraft, and direction-finding often revealed the bases involved. The high-frequency traffic was used by the German bombers on operations, and the wireless discipline of these units was poor, enabling Cheadle to make frequent early and accurate guesses of the units taking part in a raid. 'By September 1940 Cheadle was so expert in correlating M/F and H/F traffic that it would identify the majority of bomber units very soon after the start of each operation.'¹⁴

At the same time the arrival of German fighter units in north-eastern France and the Low Countries had brought their radio-telephone conversations within range. The organisation for the interception of these signals expanded rapidly after Dunkirk, and was based at Kingsdown. The radio discipline of Luftwaffe fighter units was no better than that of the bombers, and vitally important operational information was intercepted. The interception units 'could, on occasion, determine where enemy aircraft were forming up for a raid outside radar's detection range, give the altitude of the aircraft', and indicate the type of aircraft in the formation.¹⁵ This was of incalculable value to the hard-pressed fighter controllers, who were otherwise reliant on relatively crude radars which were frequently not capable of establishing this sort of information even when enemy formations had come within range. Direct telephone lines were laid between the interception units and the local Group and Sector

headquarters, as well as to Fighter Command, so that operationally vital information could be passed as rapidly as possible. The contribution of low-grade sigint to the difficult task of assessing the enemy's intentions from the confused and conflicting radar tracks on the operations table was obviously of great importance. It was also one of the few sources capable of giving warning of low-level attacks, which were almost immune from radar detection until 1943.

From September 1940 until May 1941 the main weight of the Luftwaffe offensive was switched to night bombardment. The preparations for a prolonged bombing offensive, including the lengthening of runways, accumulating stocks of bombs and fuel, the arrival of new bomber units, and the burgeoning communication and navigation beacons were detected by AI, and reported to the Chiefs of Staff. The night offensive increasingly became the main focus of concern, and its ultimate failure was in no small measure due to the success of Air Intelligence in the 'Battle of the Beams'.

When the Luftwaffe resumed its bombing attacks on Britain in April 1942 its general signals security was greatly improved, largely because, for all but tactical purposes, its communications were all by landline. Thus, although the Air Intelligence Branch detected the reinforcement of the bombing units in the West it was unable to provide the sort of early warning of the target for the night which had been possible in 1940-1. The defeat of the 1942 'Baedeker' offensive was largely achieved by improvements in the British night fighters, and the weakness of the Luftwaffe, rather than operational intelligence. Such intelligence as was obtained came from low-grade sigint, POWs, and photo-reconnaissance, and not from the more 'normal' sources. The Germans also used deception and other passive techniques to reduce the intelligence value of their 'Knickebein' (radio navigation system) transmissions. Much the same conditions applied to the defeat of the Luftwaffe night-bombing offensives of 1943 and 1944.¹⁶

Perhaps more interesting from the intelligence point of view are the daylight offensive operations of Fighter Command after the Battle of Britain. From June 1941 Fighter Command mounted a series of offensive sweeps, often in conjunction with raids by light bombers, against targets in north-east France and the Low Countries. Their purpose was firstly to give political support to the USSR at a critical time, and secondly to inflict material damage on installations and industry, but primarily to 'tie

down' the Luftwaffe, and force the German High Command to retain as many units and aircraft in the West as possible. At the same time it was intended to inflict the greatest possible number of casualties on the German fighter units in order to assist in the strategic aim of gaining air superiority.

The offensive was split into two prolonged phases. The first lasted from June 1941 to the end of the year, and the second from March to August 1942. These extended operations incurred heavy casualties but, taken overall, failed to achieve their strategic objectives, and they were certainly a tactical defeat. Between June and December 1941 the German Air Force in the West lost 135 single-engined fighters to enemy action. Fighter Command lost 411 pilots in the same period – more than had been lost in the Battle of Britain. Fighter Command claimed, however, that it had shot down 731 enemy aircraft, the majority of them fighters.¹⁷ At the same time the strategic purpose of relieving pressure on the Eastern Front by compelling the transfer of Luftwaffe units to the West was also a dismal failure: no such transfers took place, and some bomber units certainly moved in the opposite direction. The rate of loss sustained by Fighter Command compelled the RAF to suspend operations at the beginning of 1942, but by March evidence that Luftwaffe units were now being withdrawn from the West forced the Air Staff to reopen the offensive. In the period March to June 1942 Fighter Command lost 259 aircraft on offensive operations, whereas the Germans lost only 58. More significantly from the intelligence point of view, claims were made for only 197, so that Fighter Command was aware that it was losing the attritional battle. Perhaps the most significant RAF operation was the cover flown for the Dieppe landing, where Fighter Command lost 88 aircraft and the Germans only 48, including 25 bombers. The total Fighter Command losses on offensive operations during 1942 amounted to 466 aircraft, as against claims for 280 German aircraft and actual losses of 168.¹⁸

There are several questions which arise from this. Why was RAF intelligence unable to establish a more accurate figure for German losses in 1941–2? Why was Fighter Command's offensive strategy maintained more or less unremittingly throughout the period, except for two months of 1942; and (a related question) what did the RAF believe it had achieved?

All air forces, of course, suffered from exaggerated claims. It was not a new phenomenon, and has not entirely disappeared even today. The reasons for it are, very simply, the immense

difficulties inherent in trying to reconstruct fluid and fast-moving three-dimensional combat after the event. It should be noted in this context that the more aircraft there were involved in an action the more inaccurate the claims became, probably because of increased duplication of claims for the same aircraft. In assessing the accuracy of such claims most of AI's sources were of little use. Enigma, POWs, PR and the SIS were all largely irrelevant, and since the fighting took place on the wrong side of the Channel from the British point of view, there was no aircraft wreckage to provide an independent check. Cheadle could check the losses of twin-engined aircraft via W/T intercepts, but single-engined fighters used radio-telephones (R/T), and were thus frequently beyond intercept range. Perhaps more importantly no detailed attempt to match the daily analysis of Luftwaffe R/T with other intelligence had been undertaken. Eventually this was done by the Air Section at the GC & CS, and proved of immense value.¹⁹ Thus it was largely a matter of educated guesswork, and, where a claim was made in good faith, as most were, and in the absence of any indications to the contrary, it was natural to accept it, since there was little logical basis for accepting some claims and not others.

Unfortunately the result was to convince Fighter Command during the 1941 offensive that it was inflicting twice the rate of casualties it was itself suffering, and it was very largely this mistaken analysis which caused the offensive to be prolonged. The resumption of the offensive in March was the result of political pressure applied because of disturbing signs from the Eastern Front, and direct intelligence provided by Enigma of transfers of single-engined fighters away from France to Norway and the East. The offensive reopened on the 24 March, and within a week Enigma was reporting the arrival of fighter reinforcements in France: to that extent, therefore, it was a success.²⁰ However, this still leaves open the question why it was continued when it became clear that, even with the exaggerated claims, Fighter Command was suffering much greater losses than the Luftwaffe.

The answer lies in a piece of Enigma intelligence for July which misled Air Intelligence. The decrypt revealed that the Germans were experiencing problems in providing sufficient aircraft for North Africa, had imposed flying restrictions in South Russia, and had ordered a fivefold increase in fighter production at the Wiener-Neustadt fighter-aircraft factory. The result was an over-complacent minute from Air Intelligence

stating 'There is no doubt that Fighter Command's offensive during the past few months has contributed substantially to the present satisfactory situation.' It concluded 'further intensive operations would be likely to cause the Germans most serious embarrassment'.²¹ This encouraged Fighter Command to continue the offensive, which culminated at Dieppe, despite worries over casualties. The aims of the offensive were only partially achieved with the reinforcement of the German fighter forces in the West early in the year, and further transfers of both bombers and fighters after Dieppe. This does not alter the fact that the ratio of losses to claims was known to be unfavourable, and was actually worse than was believed. All in all it may be doubted whether the retention of such very large fighter forces in the United Kingdom was wise, at a time when fierce air battles were being fought with very slender resources in Malta and the Middle East. Faulty intelligence must take a large measure of the blame for this situation.

If this was the influence of intelligence on defensive and offensive fighter operations in north-west Europe up to the end of 1942, what assessment can be made of its effect on the bomber offensive? The Official Historians are very clear in their view that 'Despite the fact that a big effort went into the study of bombing targets, intelligence could do little before the end of 1942 to increase the effectiveness of the British bombing raids. Until then, moreover, it exerted no influence on the evolution of bombing policy except for a brief period from January to March 1941. . . .'²² In fact the main contribution of the intelligence organisation was the provision of photographic cover of the build-up of invasion shipping in north-west European ports in 1940. Bomber Command put its full weight into attacks on these targets during September, and it should be noted that bombing destroyed over 12 per cent of the assembled invasion barges.²³ This demonstration of the threat posed to Operation Sealion is often overlooked, but offensive power is as much a factor in the battle for air superiority as defensive power. These attacks were a major factor in persuading the Germans, and especially the Kriegsmarine, that air superiority was not in sight, and that invasion without it would be suicidal.

Apart from this brief interlude the Air Intelligence organisation did not play any part in determining the RAF's offensive strategy, which evolved almost entirely as a result of other factors. Prominent amongst these were the strength of pre-war RAF doctrine, political pressure for retaliation for Luftwaffe

raids on Britain, and the stark reality that the bomber was the only offensive weapon available. With the exception of the period January to March 1941 the direction of the bomber offensive was dictated almost entirely by operational and strategic factors. Operationally Bomber Command was unable to find or hit precision targets by night, and was incapable of penetrating German air defences by day. Strategically Bomber Command's priorities were directed by the exigencies of the war: support, albeit ineffective, for the Army in May and June 1940, bombing of French aerodromes during the Battle of Britain, the anti-shipping attacks of September, and the anti-U-Boat campaign of mid-1941. The oil offensive of early 1941 was the result of assessments made by intelligence organisations outside the Air Ministry, namely the Lloyd and Hankey Committees, both of which concerned themselves exclusively with studying the Axis oil position.

The operational shortcomings of Bomber Command were highlighted by the Butt report of August 1941. The catalyst for this report was once again Churchill's scientific adviser Professor Lindemann, now Lord Cherwell, who had an obvious facility for pricking the more complacent assumptions of the Service staffs. The report itself consisted of a detailed analysis of bombing photographs taken by aircraft on operations in June and July. The results were a very unpleasant shock, since they revealed that only one-fifth of Bomber Command's aircraft were dropping their bombs within five miles of the target.²⁴ This depressing conclusion was of course obtained with the active participation of the Photographic Interpretation Section, and, as Mr Butt was a member of the Cabinet Office, it carried considerable weight. In fact photographic intelligence had revealed much earlier the gross inaccuracy and relative ineffectiveness of much of the bombing. In December 1940 PR sorties revealed that supposedly devastating attacks in the oil refineries at Gelsenkirchen had in fact inflicted little discernible damage. As early as October 1940 the C.-in-C. Bomber Command, Air Marshal Peirse, had concluded that in long-range attacks only one in five of the bombers he despatched found the target.²⁵ Such conclusions, however, were isolated rafts of reality fighting against the powerful waters of two decades of pre-war doctrine and the ingrained perception in the higher echelons of the RAF that difficulties were there to be overcome and not used as excuses for failure. As a result the initial reaction to unpalatable raid assessments based on PR was to doubt the efficiency of the

interpreters, and not that of the navigators or bomb-aimers. It is of course a recurring theme in military history that unpleasant intelligence that offends received wisdom is often viewed as a poor reflection on the quality of the intelligence, rather than on the operations.

Notwithstanding these doubts the offensive was continued, in part to gain the operational experience necessary to improve matters, and in part because there was still no alternative offensive weapon available. The Air Staff did come to the realisation, however, that equipment and techniques would need to be developed to assist the aircrews. There were also two other powerful factors behind the decision to continue bombing attacks on Germany. Both were political. Firstly there was the continuing and pressing requirement to relieve the military pressures on the Soviet Union, and secondly the equally important need to persuade political and military opinion in the United States to place the European war before the Far Eastern one. When, therefore, in early 1942, the Army and the Royal Navy began to question the resources being devoted to bombing compared to the results being achieved, it was these aspects as much as any which persuaded the government of its value. It is a characteristic of the British system that when a policy leads to controversy or dispute, particularly between different authorities, they appoint an eminent judge to look into it! Mr Justice Singleton, who had conducted the earlier inquiry into the strength of the Luftwaffe, was therefore called in to assist once more, and it was he who concluded that the offensive was 'of incalculable assistance to Russia'.²⁶

Certain strands which were to run right through the bomber offensive also begin to become apparent at this time. Mr Justice Singleton, in addition to giving judgement on the overall offensive, was also required to adjudicate in a dispute between the industrial experts of the Ministry of Economic Warfare, and the Air Ministry. The former charged that the offensive was not being directed at the vulnerable areas of the German economy, which must be selected for attack if the offensive was to succeed. Singleton agreed, but also accepted Bomber Command's 'view that the prime criteria in selecting targets must be vulnerability and feasibility', and that 'the final choice of target . . . must always rest with the C-in-C Bomber Command'.²⁷ This conflict was in fact never resolved, and will resurface later in this chapter. A second, and not unrelated, strand was the increasing attention being paid to the German aircraft industry. The Air

Intelligence Branch had urged, as early as January 1942, that the offensive should be concentrated on aircraft-industry targets. As has already been demonstrated, the view that German fighter production was stretched almost to the limit was one of the principal factors behind the continuation of the day fighter offensive, and it was therefore entirely consistent that it should also appear in debates over the direction of the bomber offensive. The Air Intelligence Branch went so far as to suggest the resumption of daylight bombing. These arguments were certainly considered by the Air Staff, and were ultimately rejected, reasonably enough at the time, on the familiar grounds that Bomber Command could not hit such targets at night, or reach them by day. Aircraft factories were, however, moved to a much higher place in the list of target priorities. This may have been due not only to the views of Air Intelligence, but also to pressure from the Anglo-American planners, who were anxious to stress the necessity of reducing the German fighter force.²⁸

Early 1942 was, however, a momentous time for Bomber Command, as it saw the appointment of Sir Arthur Harris as C-in-C. Aware that his Command could not fight by day nor bomb accurately at night, Harris was convinced that the correct policy was to use his aircraft as a bludgeon and not a rapier. He was not a man to be conspicuously impressed by intelligence assessments which differed from his own strongly held views. Shortly after Harris arrived at Bomber Command Lord Cherwell wrote another of his influential minutes to the Prime Minister. This one, on the subject of bombing policy, argued the case for area bombing of German cities with the object of de-housing the industrial work-force, and thus destroying both the German economy and civilian morale.

Thus a coincidence of various political, military and personal factors combined with the lack of any viable alternative to give Harris his chance to prove his point at a time when Bomber Command was about to re-equip, this time with four-engined bombers and Mosquitoes, and receive the first of its radar navigation aids, GEE. The result was that in 1942 Bomber Command, for the first time, started to display technical proficiency.

By January 1943 the USAAF's 8th Air Force, having conducted some preliminary sparring with the Luftwaffe over France, was ready to test its particular strategic doctrine over Germany. In the same month the Allied politico-military leadership met at Casablanca to hammer out the grand strategy for the next phase of the war. In fact, as far as the bomber offensive was concerned, in the

words of Noble Frankland, 'Instead of initiating a combined bomber offensive, the Casablanca Directive began a bombing competition.'²⁹ General Eaker was to conclude within a few months that the one essential for the success of his offensive was air superiority, and that meant that priority must be given to the Luftwaffe and the aircraft industry, as Air Intelligence had urged the previous year.

At the Washington Conference in May 1943 Eaker's reasoning was echoed by the Combined Chiefs of Staff, who had become alarmed by the ever-increasing casualties in both bomber forces. They concluded that 'if the German fighters are materially increased in numbers it is quite conceivable that this would make our daylight bombing unprofitable and perhaps our night bombing too'.³⁰ The result was the Pointblank Directive, which ordered 8th Air Force to give priority to the German fighter force, and instructed Bomber Command to design its attacks 'as far as possible to be complementary to the operations of 8th Air Force'.³¹ Ironically the production intelligence on which the future offensive was, in part, to be based was becoming increasingly unreliable at this time. The Air Intelligence Branch had recognised at the time of the Barbarossa invasion that German aircraft production must have been over-estimated, since Enigma was revealing the strain which the Russian campaign was imposing, whereas previous estimates had indicated that the Luftwaffe should have been able to absorb such losses without undue difficulty. A special section was therefore set up to study German production. Using Enigma information, sigint from delivery flights of twin-engined aircraft, SIS reports, particularly from the occupied territories, and manufacturers' plates from crashed aircraft AI2(a) was able to produce accurate, if somewhat belated, intelligence on German production.³² Accurate that is until early 1943. By the spring of 1943 order-of-battle intelligence was beginning to conflict with production intelligence, and it became obvious that a sharp increase in single-engined fighter production had been achieved – in point of fact due to the reforms of Speer and Milch. It was of course this increase which threatened the Allied offensive, and led to the switch in strategic priorities. It is interesting, though, that the strategy was adopted because of accurate intelligence on the increased threat posed by the enemy, whilst simultaneously intelligence on the overall capacity of the target system itself was steadily becoming less accurate. The Germans had started to introduce deceptive numbering systems which negated much of

the value of manufacturers' plates. In addition the increased emphasis on single-engined fighters rendered sigint sources less effective, because fighters carried no W/T, and the physical effects of visible damage on PR photographs were over-estimated.³³

These shortcomings did not, however, affect the selection of targets. Once the German fighter industry had become the main priority in the summer of 1943 a special committee, the Jockey Committee, was set up to bring together the intelligence organisations with the operational commands. The Jockey Committee met weekly from June 1943 to April 1945, and drew up schedules of aircraft-industry targets to be attacked. A weekly signal was then sent to commands showing the targets suspended due to damage, targets sufficiently repaired to justify renewed attack, and new targets.³⁴ The work of the Jockey Committee should have formed the basis for target selection by the Strategic Air Forces, and for 8th Air Force this was indeed largely the case. For Bomber Command, however, the phrase 'as far as practicable' in the Pointblank Directive allowed Sir Arthur Harris the loophole which had earlier been used to deflect the criticism of the Ministry of Economic Warfare. For the rest of 1943, whilst 8th Air Force fought its way to various targets associated with aircraft production, Sir Arthur Harris fought successively the Battles of the Ruhr, Hamburg and Berlin. On 27 September 1943 the Deputy Chief of the Air Staff, Sir Norman Bottomley, pointed out that Bomber Command had still not attacked a town associated with aircraft production, though some three and a half months had elapsed since the Pointblank Directive. The Americans suffered heavily over Schweinfurt and Wiener-Neustadt in October, and made some highly critical noises about Bomber Command's obsession with area bombing. Harris countered by arguing in his inimitable fashion for the concept of destroying Berlin, and he was supported, perhaps crucially, by the Assistant Chief of Air Staff (Intelligence).³⁵ By continuing to argue Harris was enabled to continue the Battle of Berlin into January. By now, however, Bottomley was convinced that the appreciations of the experts at the Ministry of Economic Warfare were correct. Furthermore Enigma intelligence continued to record increasing German strength in day and night fighters. Following the heavy casualties of the autumn, which had compelled the 8th Air Force temporarily to abandon raids over Germany, Bomber Command in turn suffered severely over Berlin in early 1944. This was followed by its own 'Schweinfurt'

during the attack on Nuremberg. As the Official History of Intelligence points out, only firm evidence that the more optimistic estimates of the effect of area bombing on morale and production were wrong could perhaps have deflected Harris. Morale, however, was an intangible target which it was almost impossible to assess accurately, even when Enigma decrypts of Japanese diplomatic and German police traffic gave some clues.³⁶

In the event it was again the strategic realities of the war which intruded forcibly into these disputes. The Air Staff, conscious that air superiority was vital for the impending invasion of Normandy, ordered Harris to change strategy. On 14 April 1944 the strategic bomber forces came under Eisenhower's command – a command which he exercised through Sir Arthur Tedder – and the strategic focus of the bombing campaign swung inexorably away from Germany to the French railway system. The provision of intelligence for these attacks, and the assessment of their success was an immensely easier task than that of attempting to predict German production and morale. Sir Arthur Harris himself was surprised by the degree of precision achieved by his bombers in these attacks, which he had considered technically beyond his means. In this he was not alone. The Directorate of Intelligence at the Air Ministry, the Ministry of Economic Warfare, the American Economic Objectives Unit and the Directorate of Transportation at the War Office united in their condemnation of the transport plan with the Joint Intelligence Committee.³⁷ At a meeting attended by Eisenhower, Portal, Tedder, the senior AEAFF and bomber commanders, and intelligence representatives, Tedder found himself almost alone in advocating its adoption. Crucially, the only alternative strategy suggested was a renewed attack on oil, which would not take effect rapidly enough to assist during the crucial early weeks after 6 June. The transport plan was therefore adopted, because it was believed it would have some direct effect on Overlord, but it was 'forced through on the demerits of the oil plan rather than on its own merits'.³⁸ Significantly, perhaps, Tedder was persuaded of its feasibility by the similar campaign which had been conducted against Italian railways before the invasions of Sicily and Italy, and he was reinforced in that view by Zuckerman, another of the eminent scientists who seem to have played such key roles in these disputes with the intelligence authorities.

Whilst the strategic bombers devoted considerable effort to

French communications they did not neglect other targets. V-weapons absorbed a high proportion of sorties – another target forced upon the commanders by the realities of the war; but a renewed attack on oil also took place from mid-1944. Oddly enough it became a target not through being allotted a prime position in any bombing directive, but rather by informal arrangement between General Eisenhower and General Spaatz, and between Sir Arthur Tedder and Sir Arthur Harris. At the same time, that is to say from July 1944 onwards, the oil intelligence reports of the Joint Intelligence Committee were indicating to the Air Staff the increasingly desperate position to which the comparatively minor Allied attacks had already reduced German oil production. The bombing offensive was still, however, controlled by SHAEF, whose priorities were somewhat different. Also in July, perhaps in an attempt to obtain authoritative intelligence with which to try and influence bombing policy, the Air Ministry announced the formation of a joint Anglo-American oil-targets committee to review the Axis oil situation and assess the damage inflicted. This was of crucial importance, because intelligence indicated that even the peripheral attacks so far made had produced a situation which seemed to offer the chance of a decisive stroke against oil. 'The importance of attacking the correct targets in sufficient force and with adequate frequency, therefore, became greater and greater.'³⁹

There was a good deal of blurring of lines of control, and much disagreement about the best possible target systems during the late autumn of 1944. The tendency had been to set up specialised committees for each target system, along the lines of the Jockey Committee, and it was the advice of these committees which the Joint Intelligence Committee drew on in its reports to the Chiefs of Staff. By the autumn of 1944 there was a feeling that this loose collection of miscellaneous committees should be drawn together to give co-ordinated and scientific direction to the offensive. The Anglo-American Combined Strategic Targets Committee was the result, and it included representatives of the Air Staff, SHAEF, 8th Air Force and Bomber Command, and the intelligence organisations, both economic and military. The Committee was intended to tender advice to the Deputy Chief of the Air Staff and the Commanding General US Strategic Air Forces on the direction and priorities of the offensive. Whilst it did much useful work on targets and target systems it never exercised the sort of influence which had been intended on its formation. This was because 'Neither of the

two commanders was prepared to accept the advice of the Committee except when he agreed with it.⁴⁰ In fact there was little agreement on which target system constituted the most favourable point for attack. The Air Staff and General Spaatz favoured oil, SHAEF, particularly Tedder, favoured communications, and Sir Arthur Harris was still wedded to the notion of general area bombing of industrial centres. The Official History of the Bomber Offensive makes the pertinent observation that 'in pinning their faith to the oil plan in November 1944 there can be no doubt that the Air Staff were acting upon intelligence which was fundamentally . . . correct'.⁴¹ Nevertheless, it accepts that the oil and communications plans were not necessarily mutually exclusive: they were also, in Sir Arthur Tedder's phrase, 'common denominator' target systems, i.e. they both contributed to the overall weakening of Nazi Germany and were at the same time of direct benefit to the armies fighting on the ground. The policy of general area bombing, which, as has been demonstrated, was for a very long period dictated by operational imperatives, was not a 'common denominator' system, and raised more fundamental issues.

These differences led to a long and increasingly acrimonious dispute between Sir Charles Portal and Sir Arthur Harris, which is beyond the scope of this chapter. It is relevant to note, however, that Sir Charles Portal based a large part of his argument on intelligence. Thus, in a letter of 5 November 1944, he wrote 'in the light of all available intelligence I feel that the whole war situation is poised on "oil" as on a knife edge, and that by a real concentration of effort at this time we might push it over on the right side'.⁴² That Harris's views on intelligence were coloured more by faith than objectivity is perhaps indicated by his statement in a letter to Portal of 28 December 1944, in which he wrote that 'I have no faith in anything the M.E.W. says'.⁴³ So far as Sir Arthur Harris was concerned oil was another in a long list of 'panacea' targets. Sir Charles Portal in his reply pointed out that M.E.W. was only one element in providing the intelligence appreciations, and that it was in fact the Joint Intelligence Committee which had tendered the advice on which the oil plan was based. He also pointed to the fact that Germany had successfully weathered previous area offensives with no sign of imminent collapse, and that there was doubt over how many further such attacks would prove 'decisive in themselves'. He then stressed that 'the sounder policy [is] now to employ the bomber forces so that they can make a calculable contribution to

the offensive as a whole'.⁴⁴ The implied criticism being that Sir Arthur Harris's policy was not susceptible to rational analysis on the basis of intelligence, whereas the oil plan was. Ultimately a sterile impasse was reached, and Sir Arthur Harris actually implied that it would be better if he were replaced. Sir Charles Portal backed away from this course because the cure would have been worse than the disease. The German collapse was eventually brought about by the continued pressure from armies to the east and west, and air forces in the skies above, but the opportunity to finish the war sooner was perhaps sacrificed to Sir Arthur Harris's jaundiced views on unpalatable intelligence, and the reluctance of Sir Charles Portal to sacrifice his most important operational commander to a dispute over bombing policy.

A general conclusion about RAF intelligence during the Second World War would perhaps be that its early performance was variable, but not at all discreditable, and that it had a positive influence on the successful outcome of the Battle of Britain. The conduct of such a battle from the defender's point of view is largely dependent on information on the enemy air force, a subject in which Air Intelligence was, if not perfect, certainly by September 1940 good enough. The intelligence needed for the successful conduct of an offensive was a far more difficult prospect, and the shortcomings of intelligence in the relatively simple realm of offensive fighter operations are perhaps indicative of that.

The successful prosecution of the bomber offensive required wide-ranging, complex, and in areas such as morale relatively subjective, intelligence. By the end of the war this intelligence was forthcoming, and remarkably accurate. Nevertheless, the conduct of the offensive was, in the final analysis, subject to so many other important factors, operational, political, and eventually personal, that it cannot be said that intelligence was at any stage the final arbiter. Indeed one might question whether it should ever be. Given the fact that intelligence on the bombing offensive of late 1940-early 1941 indicated that it was totally ineffective, at that point the Air Staff, and indeed the government, were sustained by a faith totally at variance with the known facts of the situation. Had they been more inclined to accept the bare facts, Britain would perhaps have sued for peace.

Notes

1. This first section is based on the Air Historical Branch Narrative: 'Air Ministry Intelligence'.
2. Air Historical Branch Narrative: 'Photographic Reconnaissance', Vol. I, pp. 45-57, PRO/AIR41/6.
3. Ibid., pp. 67-72.
4. Ibid., p. 84.
5. Ibid., p. 78.
6. The following paragraphs are also based on 'Photographic Reconnaissance' pp. 103-24.
7. 'Air Ministry Intelligence', p. 33.
8. Ibid., p. 34.
9. The following paragraphs are also based on 'Air Ministry Intelligence' *passim*.
10. F. H. Hinsley *et al.*, *British Intelligence in the Second World War*, London, 1979-88, Vol. I, 1979, pp. 173-4.
11. Ibid., pp. 177-8.
12. Ibid., p. 179.
13. Ronald Lewin, *Ultra Goes To War*, London, 1978, pp. 84-7.
14. Hinsley *et al.*, *British Intelligence*, Vol. I, p. 181.
15. Ibid.
16. Hinsley *et al.*, *British Intelligence*, Vol. II, pp. 235-43.
17. Air Historical Branch Narrative: 'The Air Defence of Great Britain', Vol. IV, Part V, para. 120 and Appendix V(F), PRO/AIR41/18.
18. 'The Air Defence of Great Britain', Vol. V Appendix 10, PRO/AIR41/49.
19. Hinsley *et al.*, *British Intelligence*, Vol. II, pp. 271-3.
20. Ibid., p. 270.
21. PRO/AIR41/49, p. 114.
22. Hinsley *et al.*, *British Intelligence*, Vol. II, p. 257.
23. Denis Richards and H. St G. Saunders *Royal Air Force 1939-1945*, rev.edn., London, 1974-5, Vol. I, p. 187.
24. Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany*, Vol. IV, London, 1961, Appendix 13.
25. John Terraine, *The Right of the Line - The Royal Air Force In The European War 1939-1945*, London, 1985, pp. 267, 274-5.
26. Hinsley *et al.*, *British Intelligence*, Vol. II, p. 264.
27. Ibid., p. 265.
28. Ibid., p. 266.
29. Air Historical Branch Narrative: 'The RAF in the Bombing Offensive Against Germany', Vol. VII - The Planning of the Bombing Offensive and its Contribution to German Collapse', p. 107 (written by Dr Noble Frankland), PRO/AIR41/57.
30. Hinsley *et al.*, *British Intelligence*, Vol. II, p. 291.
31. Ibid.
32. Ibid., p. 142.
33. Ibid., p. 144 and 'Air Ministry Intelligence', p. 237.
34. 'Air Ministry Intelligence', pp. 237-8.
35. AIR41/57, p. 117.

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36. Hinsley *et al.*, *British Intelligence*, Vol. III, Pt 1, p. 298.
37. AIR41/57, p. 141.
38. *Ibid.*
39. Webster and Frankland, *Strategic Air Offensive*, Vol. III, pp. 49-50.
40. *Ibid.*, p. 216.
41. *Ibid.*, p. 74.
42. *Ibid.*, p. 83.
43. *Ibid.*, p. 87.
44. *Ibid.*, p. 89.

Scientific Intelligence of the Royal Air Force in the Second World War

R. V. Jones

The rapid increase in the applications of science to warfare in the twentieth century made it inevitable that, sooner or later, intelligence concerning such applications by potential opponents would become as important as the conventional branches of naval, military and air intelligence. None of the major Powers, however, seems to have had an organisation specifically for scientific intelligence until 1939, when the creation of such an organisation was triggered in Britain by the threat that the Luftwaffe was thought to present.

Radar in Britain had sprung rather earlier from the same origin, when the recognised ineffectiveness of existing air-defence techniques had led to the appointment in 1935 by the Air Ministry of the Committee for the Scientific Survey of Air Defence under the chairmanship of Henry Tizard. The CSSAD, or Tizard Committee as it came to be called, fostered the development of radar and, with it, the development of the reporting, command and control techniques that would be necessary if the flow of information coming from a chain of radar stations were to be handled with adequate capacity and speed. The success that crowned the Committee's work became manifest in the Battle of Britain.

A further question that the Committee considered was this: if Britain had radar, did Germany have it too? Enquiries from the British Intelligence Service (MI6) showed that this Service had almost no knowledge of scientific and technical developments in Germany, the Service excusing itself with the statement that it had hitherto concentrated on obtaining political, strategic and order-of-battle intelligence. Under pressure from the Tizard Committee, the Service agreed to accept a scientist who would be charged with examining the arrangements made for gaining

intelligence regarding the applications of science to warfare and with suggesting ways by which these arrangements might be improved.

The Committee had in mind the appointment of a senior and eminent scientist whose recommendations would command respect, but its hopes were dashed when the British Treasury refused to make any money available for his salary, on the grounds that no such appointment could be justified and that all that would be needed was to ask British scientists to talk to German scientists at international conferences; and since the laws of science were common knowledge across national frontiers this should be enough to assess what German scientists might be able to do.

The intentions of the Tizard Committee were therefore frustrated – until early in 1939 its Secretary suggested that I might be recalled from the Admiralty Research Laboratory, to which I had been seconded in the previous year, and that such a transfer would not cause any increase in Air Ministry pay-roll; and although I was not nearly so eminent and senior as the man the Committee had had in mind, I might be better than nothing.

By coincidence, the date agreed for my transfer to intelligence was 1 September 1939, and almost immediately I was faced with a question from Prime Minister Chamberlain to elucidate what Adolf Hitler meant when on 19 September 1939 he had said – according to the British Foreign Office translation – that he had a secret weapon. On looking at the evidence I decided that it was not a secret weapon that he had been talking about but the Luftwaffe, and that the translation had been misleading. That alarm over, I sat down to the task for which I had been appointed – to find why British Intelligence was so defective in scientific and technical matters, and to propose remedies. I proposed that all three Services – Navy, Army and Air – should have scientific intelligence sections, while MI6 which included the Government Codes and Ciphers School at Bletchley, should also have a section. My scheme was accepted by the Directors of Intelligence of the three Services, and by the Directors of Scientific Research of the War Office and the Air Ministry; but the Director of Scientific Research of the Admiralty would not agree – he wanted all raw intelligence on naval scientific matters to go direct to his offices. Besides, so his Deputy Director said in a minute of 29 February 1940 that has only recently come to light,¹ there was in scientific intelligence 'not enough work to justify

the employment of two people' even to cover intelligence for all three armed services. So I was refused even a single assistant, and I had to plead to be allowed to continue in the work myself rather than let it be neglected entirely, such was the strength of the Admiralty scientists' opposition.

I was convinced that sooner or later, and probably sooner, events would show how necessary good scientific intelligence would be – and even before the Admiralty's discouraging minute I had learnt that a Luftwaffe prisoner-of-war had mentioned something called the *X-Gerät*, which I guessed to be some form of device for blind bombing. All through the 'phoney war' period of 1939–40, realising that the only way of convincing those who doubted the need for scientific intelligence would be by example, I had been building up contacts with all the intelligence-collecting agencies. I had told them of the kind of activity that I believed to be worth looking for, and this mention of the *X-Gerät* – overheard by our prisoner interrogators – was one of the first results that came to light.

Here was an example where the less the information you have about the enemy, the greater is the number of possible interpretations that the information permits. Given that the prisoner's comments seemed to point to a device or system for blind bombing, and that radio might be somehow involved, there were at least two quite different possibilities. The first was an airborne radar mapping device such as we ourselves later developed as H2S, known to the Luftwaffe as 'Rotterdam', while the second might be a system of intersecting radio beams. A Rotterdam-type device was hinted at by the prisoner's mention of 'pulses', while an intersecting system of crossed beams was suggested by the letter 'X'. On enquiring from our own radar experts about the 'Rotterdam' possibility, I found that they thought this most unlikely because they thought that towns would not show up sufficiently sharply on long-wave (1.5 metre) radar, while on centimetric radar there would be so many echoes from hedges and ploughed fields that towns would not be easy to distinguish from the general background. Here they were wrong, since they had overlooked the enhancement of radar echoes from towns, where the many surfaces could often combine to give corner-reflections; and indeed the Rotterdam possibility was only discovered later when strong echoes from towns were incidentally observed on airborne centrimetric equipment designed for intercepting bombers. But this erroneous thought fortunately led me to conclude that the *X-Gerät*

was much more likely to involve an intersecting beam system than airborne radar.

I was further encouraged in the beam idea by a note we found in a paper salvaged from a shot-down aircraft of K.G.26 in March 1940 which said that a *Funkfeuer Knickebein* would be operating on 315°. It seemed to me that the only reason for specifying a bearing for a radio beacon could be that it was transmitting some form of directional beam, but what else could we find about *Knickebein*? A prisoner told our interrogators that he thought that it was something like the *X-Gerät*, but that was all we could learn. At that time we had few aerial photographs of Germany, and although I had pressed MI6 for all available reports of possible transmitting antennae that its agents in Germany might have reported before the outbreak of war, none of them seemed promising as beam transmitters. Despite the fact that the *Knickebein* installations at Husum, Kleve and Lörrach had antennae one hundred metres wide and thirty metres high, none of them had been reported by MI6, which indicates how technically insensitive it had been before 1939. And our radio interception service, which had done so well in the First World War and was to do so brilliantly with Enigma, had failed to intercept any transmissions which suggested beam characteristics.

Despite these failures in espionage and photographic and electronic reconnaissance, I felt sufficiently convinced to state my belief that our opponents had a beam system that would be no more than half a mile over London in a report that I was asked to write to warn the new Prime Minister, Mr Churchill, and others on 23 May 1940 of the new weapons that we might have shortly to face. But, even though my secretary accidentally typed $\frac{1}{2}$ metre instead of $\frac{1}{2}$ mile, there was no reaction from those who received my report.

And then, on 12 June 1940, I received clear evidence from an early Enigma decrypt of the *Knickebein* at Kleve. This proved the key to solving the puzzle, along with further evidence from prisoners and papers on shot-down aircraft, with the radio interception service finally hearing the *Knickebein* signals and, three months later, a *Knickebein* transmitter being found in air photographs of the Cherbourg area after Enigma had given us its co-ordinates.

In the mean time, on 21 June 1940 I had been summoned by Mr Churchill to tell him my conclusions about *Knickebein*, as he afterwards recorded in his *Memoirs*. Thanks to his interest, now

fully aroused, the highest priority was given to our investigations and the development of countermeasures: these were ready just in time as the night onslaught on London began on 7 September.

The effect on Mr Churchill of the value of scientific support in the Battle of Britain, with radar by day, and in the Blitz with electronic countermeasures by night, was so great that in Volume II of his *Memoirs* he wrote:

Thus the three main attempts to conquer Britain after the fall of France were successively defeated or prevented. The first was the decisive defeat of the German Air Force in the Battle of Britain Our second victory followed from our first. The German failure to gain command of the air prevented the cross-Channel invasion . . .

The third ordeal was the indiscriminate night bombing of our cities in mass attacks. This was overcome and broken by the fortitude and endurance of the mass of the people, and notably the Londoners, who, together with the civil organisations which upheld them, bore the brunt. But these noble efforts in the high air and in the flaming streets would have been in vain if British science and British brains had not played the ever-memorable and decisive part which this chapter records.

With Churchill's appreciation, the value of science and of scientific intelligence was established, and henceforward responsible governments knew that they could not afford to neglect either of these activities. Even so, such had been the strength of earlier resistance that it was only in November 1940 that I was allowed to have a single assistant – and even then only because from the basis of the Enigma decrypts of K.Gr.100 signals I was frequently determining in advance the nightly targets and hence alerting the night-fighter, ground and civil defences on where they should concentrate attention. And if, as nearly happened several times, I should become a bombing casualty, there was nobody else who would know how to take over.

Fortunately, many of the senior officers of the Royal Air Force, and particularly Sir Charles Portal, the Chief of Air Staff, his Vice-Chief, Sir Wilfrid Freeman, and his Assistant Chief of Intelligence, Sir Charles Medhurst, all immediately realised from the beam episode the further contributions that scientific intelligence could make; and they increasingly brought me in to their discussions of threats to their operations and the tactical

and electronic countermeasures against these threats.

Knowing that the Royal Air Force was to be committed to night attacks on Germany, for example, when one of the limiting factors would be the effectiveness of the German night defences, Medhurst at our first meeting after his appointment early in 1941 told me how impressed he had been with our work on the beams, and asked me to take the responsibility for intelligence concerning the night defences, especially since these would have to depend on technical aids such as radar.

Actually I had started on radar immediately on my appointment in 1939, for it was partly our lack of evidence about German radar that had led to that appointment. But if our pre-war intelligence service had failed to observe the huge *Knickebein* antennae, there was little hope that it would have observed the much smaller *Freyas*. All that we could conclude was that if German radar existed it probably used much smaller installations than the 110-metre-high towers of the British radar chain. And there was the evidence of the anonymous report sent to our naval attaché in Oslo that German radar existed in two forms, one of which used parabolic reflectors. Moreover, in July 1940 Enigma signals mentioned something called *Freya* near Cherbourg, which to me appeared to have features which indicated radar.

Of course, all through this period my experience of intelligence work was increasing; and at the same time our intelligence organisation as a whole was recovering from the shock of expulsion from the European mainland and bringing in many men and women from civil life to work in its numerous activities. So I began to feel that I could now plan intelligence attacks on specific objectives such as German radar using the various techniques of intelligence such as cryptography, electronic and photographic reconnaissance, espionage, prisoner interrogation and the examination of captured equipment, much as a military commander planning to take his objective uses his various arms – artillery, tanks, infantry and air support – to work together, each making the contribution for which it is best fitted.

To conduct his campaign in this way it follows, of course, that a commander must know each of his arms well enough to understand what it can best do, and the tasks that some other arm could do better. And a very good preparation for a budding commander would be to spend some time at the various working levels of each arm from the front-line or 'sharp end' upwards. I myself was particularly fortunate in that during the

'phoney war' period I had come to know all the organisations involved in the collection of intelligence, particularly at the working level. Moreover I had worked with the Royal Air Force from 1935 onwards, having been involved in flying trials of infra-red detectors at Farnborough, and I had developed some appreciation of operational problems as they might appear to a Royal Air Force officer.

This was all the easier because I was treading a path which had already been beaten by the generation of scientists who were my teachers in the inter-war years, and who had worked with airmen in the First World War. Two of the great figures of the Second War, Professor Lindemann (Churchill's scientific adviser and my professor at Oxford) and Sir Henry Tizard (a chemist, and chairman of the Committee for the Scientific Survey of Air Defence), for example, had both been experimental pilots in the First War. And one of the lessons that they had learnt was the need for the closest possible relations between scientists and serving officers at all levels.

Naturally many serving officers were at first doubtful about taking scientists fully into their confidence. Typical of this reaction had been that of Commodore S. S. Hall of the Royal Navy in 1917, regarding the reasonable requests of the scientists, including Rutherford, who had been called in to help with the problem of detecting U-Boats, and who said that their help would be more effective if they could have some experience of the operational problems involved at sea, and more knowledge of the methods already in use. Commodore Hall resisted this request with the opinion that 'the only information necessary to be given was that the enemy submarines were in the sea, and that means were required to detect their presence'.²

The Royal Air Force, being a younger and more progressive Service, was less resistant to scientific help than some of the naval officers had been; but there were notable differences in the attitude towards scientific help between the various Commands in the years before 1939, and particularly between Fighter and Bomber Commands. The difference was of such lasting importance that it is worth recounting. The very close relations between the scientists and the officers of Fighter Command were the result of that Command's recognising from 1933 onwards that it could not provide an effective defence against air attack because it could never have enough aircraft to maintain standing patrols, and its only hope would be to know where incoming raids were approaching, so that it could send up fighters to

intercept. This required long-range detection, for which no means then existed. In this emergency the Service was prepared to consider any means by which it might be helped. The result was the formation of the Tizard Committee, which we have already mentioned. Listen to what Tizard himself said in 1946 when reviewing the Committee's contribution:

The first time, I believe, that scientists were ever called in to study the needs of the Services as distinct from their wants, was in 1935, and then only as a last resort. The Air Staff were convinced of the inadequacy of existing methods and equipment to defeat air attack on Great Britain, and a Committee was established for the scientific survey of air defence. I want to emphasise that this committee, although it consisted on paper only of scientists, was in fact from the first a committee of scientists and serving officers, working together When I went to Washington in 1940 I found that radar had been invented in America about the same time as it had been invented in England. We were, however, a very long way ahead in its practical applications to war. The reason for this was that scientists and serving officers had combined before the War to study its tactical uses. This is the great lesson of the last war.³

With the Committee setting the pattern of close relationships between scientists and serving officers, it was natural for us at the working level to share experiences on a continuous basis. Typical of that working would be for the RAF officers to tell us the kind of equipment that they would like to have. Often we would have to say that we could not achieve exactly what they wanted, and then describe the nearest that we thought we might be able to do, and ask them whether they could think of a way of using it. Through this process the technical development of radar by the scientists, and the operational development by the RAF officers to use it to best effect, grew up together – which is why Tizard could justly say that in 1940 we were 'a very long way ahead in its practical applications to war'.

But if Tizard were right, and I am sure that he was, in saying that the effective combination of scientists and serving officers was 'the great lesson of the last war', there was another lesson, hardly less important, to be drawn from his experience. You will have noticed that he said that scientists were called in 'only as a last resort', and the prime reason for calling them in was the vulnerability of Britain to air attack.

By 1937 the impact of the Tizard Committee on air defence and Fighter Command was so successful that it was proposed

that a parallel committee should be set up to consider the problems of Bomber Command; and so the Committee for the Scientific Survey of Air Offence was instituted, and Tizard was made its chairman. But although the CSSAD had been so successful, the CSSAO was a failure; Tizard himself diagnosed the reason – 'It did not meet with such enthusiastic welcome from the Air Force. As a result, its influence before the war started was only small.'

We must now ask why the welcome in the offence case was less enthusiastic. Part of the answer might lie in the fact that in the years that had been shocked by the slaughter of the First World War there was a revulsion against offensive techniques: but this hardly applied to Bomber Command, whose officers were committed at least to the bombing of military targets. The main answer, therefore, lay elsewhere: it was simply in the complacency of Bomber Command, which enjoyed the Trenchard doctrine of the supremacy of the bomber, backed by Prime Minister Baldwin's observation that 'the bomber will always get through'. Bomber Command not only believed that its bombers would get through, but also that by a combination of astronavigation and dead reckoning they would accurately bomb their targets by night. They would therefore not need what one senior officer called 'adventitious aids' such as radionavigation, which were to be distrusted because of their vulnerability to radio countermeasures.

So here was a tremendous contrast: Bomber Command complacently believed that it could carry out its tasks with little aid from the scientists, while Fighter Command had realised its shortcomings and was desperate for their help. The scientists of the Tizard Committee were therefore able to work with them to great effect, while virtually the same committee, led by the same chairman, could do little for Bomber Command. So to Tizard's 'great lesson' I would add another: it is only when an organisation realises that it needs help that you may be able to help it, and your first task, if as an external observer you can see that an organisation needs help, is to awaken the organisation to this fact.

Following in Tizard's footsteps in 1940 and 1941, I had the same experience. If, as a scientist you were visiting Fighter Command, the Commander-in-Chief himself would readily see you if he thought you might be able to help. If, by contrast, you were visiting Bomber Command, it was more like a gentleman's country club, where you would be given a generous lunch, and

some middle-rank officer would listen courteously to what you had to say – but you left with the impression that little would come of it.

As for the contrast between the two Commands, I have encountered two similar instances in different fields. Before the war I had worked both with the Navy and the Air Force, and while the Navy had many virtues it tended to complacency much more than did the Air Force: in this complacency it believed that battleships could survive against bombers, and it was also slow to develop radar. I saw a similar contrast in the post-war years when I was called in to help the Transport Commission with its research problems. The railways were rather like the Navy; they had been a mainstay of the country for a century. They were the men with the heavy ironware, and they knew how to do their job and, confident of past success, they were resistant to change. The road-transport organisation was quite different: long-distance road haulage was new, its equipment was much lighter, and its officers ready to try anything that might produce better results. These experiences with Bomber Command, the Navy, and the railways convinced me of the shrewdness of Dean Inge of St Paul's Cathedral, who once said 'Nothing fails like success'! If, as Thucydides said, 'history is philosophy teaching through examples', then these showing the dangers of complacency are worth recording for future generations.

There is another point from my experiences which may be worthy of attention. When I met them in 1945, both General Kammhuber, who had commanded the German night defences, and General Martini, the Director General of Signals of the Luftwaffe, were astonished to find that I was a civilian. Indeed, later in the war I was on the Air Staff, responsible to Sir Charles Portal, with some RAF officers and civilians directly responsible to me. There had been a proposal in 1940 that I should go into uniform, but I had not pressed for it – even though I had been a cadet in the Officers Training Corps for seven years – because I had been brought up by my parents to regard anyone who wore the King's uniform but who was unlikely to fight in the front line as a poseur. And I would certainly have been unhappy to have been in uniform as a relatively senior officer in the safety of Whitehall, heavily outranking officers such as photo-reconnaissance pilots who were risking their lives on sorties at my request.

I mention this simply to draw attention to the unforeseen

advantage that it gave me: because I had no apparent rank I was less inhibited than I might otherwise have been in contact with the most senior officers, and in turn junior officers were less inhibited in their contacts with me. I might, for example, be sitting with a corporal at a radio intercept station listening to German nightfighters and he might tell me of some unusual observation he had made which he would not have otherwise reported, while a few hours later I might be talking of its significance to Sir Charles Portal. This freedom to range at any level through the Royal Air Force was invaluable in enabling me to bring front-line experience immediately to the attention of the most senior officers without the attenuation to which this experience is often subjected when passed upwards through the several stages of a chain of command.

The fact that I was allowed so much freedom was due in part to the toleration of the senior officers of the Royal Air Force, most of whom were my seniors in every respect. There was also the general atmosphere generated by Churchill, who never forgot that he himself had been in very senior posts while still a young man, and who had seen the mistakes arising in the First World War because senior officers were apt to become isolated from the conditions prevailing in the front line. He had learnt in the U-Boat crisis of 1917 that the disbelief of the Admirals regarding the prospective merits of the convoy system had had to be overcome by himself and Lloyd George as civilians, listening to the experiences and opinions of the younger naval officers who were actually serving at sea. 'The firmly-inculcated doctrine', he afterwards wrote, 'that an admiral's opinion was more likely to be right than a captain's, and a captain's than a commander's, did not hold good when questions entirely novel in character, requiring keen and bold minds unhampered by long routine, were under debate.' And so he was ready to call in young men such as myself when he thought that we could contribute fresh viewpoints.

Another danger that he had seen in the 1914-18 war was that of having an intelligence service that allowed its reports to be coloured by what it thought might be acceptable to commanders. Of the Battle of the Somme he wrote: 'Sir Douglas Haig was not at this time well served by his advisers in the Intelligence Department of General Headquarters. The temptation to tell a chief in a great position the things he most likes to hear is the commonest explanation of mistaken policy.'⁴ I myself experienced the force of this observation in the autumn of 1940

when our radio countermeasures against K.Gr.100's X-system were unsuccessful, and I became unpopular with the Signals Directorate of the Air Staff for reporting the fact, when they were repeatedly claiming success in their reports to the Chief of Air Staff. They even tried to have my own report suppressed, and it was only because I had an independent voice, if necessary to Churchill himself, that the truth was faced and our countermeasures improved.

Not everyone fared as fortunately as I did. In his book *Disturbing the Universe*⁵ Professor Freeman Dyson described his experience as an operational research officer at Bomber Command: 'All our advice to the commander-in-chief was transmitted to him through bureaucratic channels. The process of filtering through a bureaucratic hierarchy limited our sharper criticisms and our more radical suggestions. As a rule the commander-in-chief was told only things that the commander-in-chief wanted to hear.'

I myself came into increasing contact with Bomber Command as the Luftwaffe threat to Britain receded after May 1941, and I was able to concentrate more attention on the German night-defence system. As for the plan of the intelligence attack, and how it was carried out – using Enigma decrypts and other signals intelligence, resistance agents' reports, photographic reconnaissance, electronic reconnaissance, pigeons, and the raid on the Würzburg equipment at Bruneval – the details can be found in my book *Most Secret War*. Finally, when in September 1942 we at last elucidated the structure and organisation of what General Kammhuber was grateful to learn that we had called 'The Kammhuber Line', I went to Bomber Command to explain it to the Commander-in-Chief. At first he did not seem unduly concerned, but as Bomber Command's losses to Kammhuber's night fighters began to rise, interest sharply increased in what we in Intelligence had to tell. The Command now began to realise its need for electronic support by radio countermeasures. In the previous year it had realised also that it needed electronic support in the form of radionavigational systems, such as GEE, H2S and Oboe, when we had finally succeeded in showing that its pre-war faith in astronavigation and dead reckoning was so ill-founded that even on short-range targets such as the Ruhr only one-tenth of its bombs were falling within five miles of their targets.

The Command's dual recognition that it urgently needed scientific aids if it were going to reduce its losses changed its

attitude. Gone was its earlier complacency, and now it was as anxious for our help as Fighter Command had been in 1939. Henceforward our help could be really effective, and we thus finished the war on the same enthusiastically warm terms with Bomber Command as we had long had with Fighter Command.

We had a similarly warm relationship, too, with the Eighth United States Army Air Force, who readily depended on us for intelligence about the radar opposition that they would encounter, and with the British Second Tactical Air Force in preparation for the Normandy landings. Here, once again, my freedom to range at any level meant that while my unit provided all the intelligence concerning the coastal radar defences, and I was a member of the party at the Headquarters of the Allied Expeditionary Air Force directing our fighter attacks and electronic countermeasures, I was able to spend some rewarding time at the operational airfields discussing with individual pilots their best methods of attack.

As with our work on the beams and the night defences, our part in the Normandy landings has been told in *Most Secret War*, which also tells of our efforts against the retaliation weapons V1 and V2. Perhaps the main lesson to be learnt from those episodes is the confusion than can arise when a premature alarm is raised by Intelligence, with the result that its normal working is invaded by too many hastily recruited officials and 'experts', whose misguided efforts clog rather than lubricate the intelligence process. In English we have two seemingly contradictory proverbs: 'Many hands make light work' and 'Too many cooks spoil the broth'. It is the second that applies the more often to intelligence.

My own unit certainly never had too many cooks. The strength of my staff, including myself, at various dates throughout the war was as follows:

- 1 September 1939 - 1
- 1 September 1940 - 1
- 1 September 1941 - 3
- 1 September 1942 - 4
- 1 September 1943 - 8
- 1 September 1944 - 11

To these numbers should be added 0.5 for secretaries up to 1.9.42, after which this figure grew to 5 in 1944, when we had to form a special overseas party, with another 3 officers and 6 flight-sergeants, to deal with the radar and other equipment that

was falling into our hands after the landings in Normandy.

I would have preferred a rather larger staff in the earlier years; but the grudging recognition of the importance of scientific intelligence until 1941 meant that I was given no chance to expand until all the best men were already well engaged on other war work, and it was rare that anyone with the right flair became free. But our small numbers resulted in a close-knit team where everyone knew what all the others were doing, and we had little need to write instructions and notes to one another.

It would be misleading, though, to give the impression that these small numbers were the total effort devoted to scientific intelligence, for I could call on the services of other officers in the main collecting agencies, such as the cryptographers at Bletchley, the photographic interpretation unit, CIU at Medmenham, the prisoner-interrogators at Latimer, and so on. Although these officers were not on my staff their commanding officers generously allowed them to work largely on my instructions in an atmosphere of mutual confidence that had grown with each success.

These successes owed much to good fortune. In the first place there was the general alarm created by the threat of the Luftwaffe, which brought serving officers and scientists together in a close relation that had never been achieved before. Then, the development of science and of electronics in particular was beginning to have a profound impact on warfare, and its applications were at a stage where individual pioneers could have great effects, both in invention and in the more parasitic activity of countermeasures. These called for the imagination of young men, and it is a tribute to the judgement of many senior officers in the Royal Air Force that they were prepared to bear with our sometimes misplaced youthful enthusiasm because, as with Churchill himself, they recognised the contribution that we could make.

Personally I was fortunate in the first three years of the war in the sense that because the importance of scientific intelligence was not yet widely realised, I was able to work without much rivalry and competition from others coveting the kudos that would reward success. One of my main fears was that there must be someone in the German armed forces who would be doing the same job on the other side. If so, he would surely be able enough to deceive me by providing false clues about German developments, and so my own task would be much more difficult – and I had only to make one bad mistake and scientific

intelligence would be discredited. Here I was again fortunate, because Germany itself was under so little threat for the first two years of the war that its scientists and serving officers were not thrust together by emergency in the way that we had been, and so they had few opportunities until too late to realise the benefits that would come from close and informal co-operation at all working levels.

Finally, I was able to work on a relatively small scale compared with today's requirements. To take a simple example of the intensification of problems that has happened since: a bomber flying over Germany in 1944 might have been the target for 10,000 radar pulses per second. By 1980, this figure was more nearly 1,000,000, or a hundred times as many, and the complication in identifying their characters and sources for counter-measures correspondingly increased. While, therefore, I hope that principles helpful in present-day problems can be drawn from our work, care has to be taken in applying them in the demanding conditions of today. Napoleon and Wellington both recognised how difficult it was to predict the outcome of large-scale cavalry actions from small skirmishes. Napoleon said that the Mameluke horsemen were so good that two of them could defeat three of his cavalymen: but a thousand cavalymen could defeat fifteen hundred Mamelukes. On the small scale individual horsemanship was the paramount factor, but on the large scale the intelligent application of disciplined force would prevail. So arrangements different from mine in 1939-45 might well be better in a future combat, where Intelligence would have to operate on a much larger scale, if only because of the vastly increased application of science to military technology.

I do believe, though, that our experiences can be valuable to future Intelligence officers for the principles that can be drawn from them, both as regards the relationship between scientists, serving officers, and those in Intelligence, and as regards the way in which Intelligence is organised. But those principles will have to be applied, not in slavish imitation, but as they may need to be modified in the conditions of apprehensive peace or future warfare.

Notes

1. Tom Bower, *The Paper Clip Conspiracy*, London, 1987, p. 27.
2. W. D. Hackmann, *Seek and Strike*, London, 1984, p. 30.
3. Sir Henry T. Tizard, 'Science and the Services', *Journal of the Royal United Services Institute*, XCI, 1946, pp. 333-44.
4. W. S. Churchill, *The World Crisis*, abridged edn, London, 1942, p. 653.
5. Freeman Dyson, *Disturbing the Universe*, New York, 1979, p. 26.

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Commentary

Michael I. Handel

The four chapters presented in Part VII of this book on intelligence and the Air War in the Second World War are all rich in detail and written by experts who know much more about their respective subjects than I do. I will, therefore, instead of making specific comments on each chapter, look for a common denominator, a common theme to all four chapters.

Before I start, there is one interesting observation that needs to be made. All the essays presented here on intelligence were written by Anglo-Saxons. Not a single paper on 'Axis' intelligence was presented. While we know now a good deal on British and to a lesser extent American intelligence, we know very little on German, and even much less so on Italian and Japanese intelligence during the Second World War.

Whether successful or not, either positively or negatively, Axis intelligence must have played a critical role in the design of German, Italian or Japanese strategy and military operations. Even if it ultimately failed, there are as many if not more lessons that can be learned from failure. There is much we need to learn about German, Italian, and Japanese attitudes to intelligence, their organisation of intelligence, codebreaking programmes, technological intelligence, deception operations, and intelligence, the co-operation (or the lack of it) between the Axis Powers, and the role of German intelligence in specific operations (e.g., the invasion of the West, the blitz on England, the U-Boat War, Barbarossa, the Air Defence of Germany, etc.).

Those and many other questions remain by and large unresearched. Much needs to be learned and explained about Axis intelligence efforts before a more balanced view of the intelligence war can be achieved and the war in general can be properly understood.

Attitudes to Intelligence and the Lack of Preparedness

The negative attitudes of all military organisations before the Second World War to intelligence work is well known. It was the result of both ignorance of intelligence work and the emphasis on operations as the key to a successful military career. 'In the US Army of the 1920s and 1930s intelligence officers did not have much prestige . . . "Misfits frequently found themselves assigned to intelligence duties. And in some stations, G-2 became a dumping ground for officers ill suited to line command,"' as Professor Futrell's chapter puts it, quoting General Bradley. Such attitudes prevailed in all other armies before the outbreak of the war, and were not easy to change even once the war broke out, while the ignorance of many military officers on everything that relates to intelligence work is not uncommon even today.

As a result of such attitudes, intelligence received low priority in terms of both budgets and manpower. The lesson to be learned here is that military professionals must learn more about the value and utility of intelligence in peacetime, and that it is too dangerous to neglect the teaching of intelligence in peacetime and to expect that somehow if war breaks out the co-operation between those responsible for operations and those responsible for intelligence will naturally develop. The professional military men must get acquainted with the contribution of intelligence to the conduct of military operations, with the potential as well as the limits of intelligence.

The Importance of the Time Factor

The outbreak of the war caught all intelligence services understaffed and ill-prepared for the new type of warfare. British air intelligence staff in 1939 included 40 officers - by 1945 it had expanded to more than 700, as Mr Cox points out. American air intelligence personnel in September 1941 consisted of 12 officers and 9 civilians, and by June 1945 of 249 officers, 5 warrant officers, 296 airmen and 420 civilians, to take Professor Futrell's figures. We don't unfortunately know anything on the mobilisation, recruiting and expansion of intelligence services in any of the Axis countries.

In 1939 none of the major Powers had any organisations specifically dedicated to scientific intelligence, as Professor

Jones states at the start of his chapter. Even in England, which depended for its survival on the quality of scientific intelligence, the need to invest in scientific intelligence was only slowly recognised, and the scientific establishment under R. V. Jones remained small until the end of the war despite the scientific and technological nature of modern war, as he himself points out.

The rapid expansion of air intelligence created many problems – in terms of recruitment and training, as well as of reorganising the intelligence community to fit the new and unexpected demands of modern intelligence. The British intelligence community, deprived of its sources of information in Europe, found that it had to rely almost exclusively on SIGINT and photographic reconnaissance (PR – until the outbreak of the war photo reconnaissance was the responsibility of the army, not the air force, as Mr Cox indicates). For this situation it was unprepared. The British organisation of intelligence was inadequate to the task. It was based primarily on a geographic division of labour, and had to shift during the war to an organisation based primarily on a functional structure. This, as has been shown by Mr Cox, was finally achieved only by 1941–2. In addition, great efforts had to be invested in co-ordinating the intelligence efforts of a large number of organisations. Given the competition between the different intelligence organisations and their different interests, this proved to be a difficult, complicated and time-consuming process.¹ Given the lack of earlier experience in air warfare and the innovative nature of air war, the demands and requirements of air intelligence took longer to establish. US air intelligence found it difficult initially even to 'develop a clear plan for its own organisation nor could it classify the type of information it deemed essential in determining the purpose and capabilities of our enemies', as Professor Futrell quotes Eisenhower as remarking.

British intelligence failed miserably in Norway, and was not yet adequate to its task during the invasion of the West. It could not guarantee that it would be able to provide adequate warning of a forthcoming invasion of England.² By the beginning of the Battle of Britain it started to improve, and SIGINT as well as PR started to provide adequate information for British air and civil defences. As the battle progressed, British intelligence gradually got better. There is no doubt that the role of British intelligence and scientific intelligence during the Battle of Britain was a decisive one. It allowed Britain to use its limited resources more effectively.

The transition from defence to offence, and the air intelligence necessary to support the strategic bombing offensive, required different intelligence and more time and experience.

US air intelligence could save much time by learning from British experience and benefiting from direct British intelligence support in Europe, as Futrell made clear. The US and Britain developed excellent co-ordination in intelligence work. While we know very little of Axis intelligence co-operation, it seems safe to assume that it was not very successful.

Given the lack of familiarity of military professionals with intelligence work, time was also necessary to learn what intelligence can and cannot do for them, to develop adequate procedures for co-operation with the intelligence community – while the intelligence community needed time to prove its value and create the necessary confidence in the military community.

The lesson for the future here is that time (i.e., learning experience and expansion) is a critical element in intelligence work. The length of a war is never known in advance – nor are the new demands made of intelligence and the new circumstances in which it will have to operate clear before the outbreak of a war. Given the rate of technological change it can only be assumed that new and unexpected intelligence problems which have not been foreseen will emerge. Time may be in short supply, and therefore – unlike what happened at the beginning of the Second World War – the preparations for any future war will have to be made in peace. The intelligence community must be mobilised at all times.

The Importance of the Existence of a Sense of Vulnerability and Weakness

This point is clearly emphasised in all the chapters of Part VII. The British (and later the Americans') sense of vulnerability and weakness, of being on the defensive and having suffered serious initial setbacks, have provided both countries with a major incentive to allocate greater resources to intelligence and to consider more carefully the advice of the intelligence community when it is given.

The British sense of vulnerability to a German attack powerfully motivated the British military authorities and civilian decision-makers long before the outbreak of the war. This is clearly shown in the chapters of Professors R. V. Jones and

Wesley Wark. The co-operation between British scientists and RAF Fighter Command began from 1933 onwards as a result of the Command's recognising that it could not provide an effective defence against air attacks 'because it could never have enough aircraft to maintain standing patrols, and its only hope would be to know where incoming raids were approaching, so that it could send up fighters to intercept. This required long-range detection for which no means then existed. In this emergency the Service was prepared to consider any means by which it might be helped,' as Professor Jones put it.

The scientists, in Tizard's words, were called on only as a last resort. Radar, as is well known, had its origins in this feeling of vulnerability. The British Navy, which had a long tradition of success and did not feel vulnerable to air power, as Professor Jones shows had a weaker incentive to develop an air-defence system, and was, therefore, much slower to show interest in the development of radar.

Professor W. Wark shows that an exaggerated perception of British vulnerability to an air attack provided a major incentive for changing the RAF doctrine from an emphasis on strategic bombing and the offensive to a defensive doctrine. This change, as Professor Wark shows, was to a large extent triggered by a report by two British officers on the German anti-aircraft defences. Impressed by German propaganda, both officers claimed that an 'air defence gap' had been created in Germany's favour. The report, based on faulty intelligence, created strong pressure in Britain to shift resources to the procurement of anti-aircraft guns and modern fighter interceptors (the Spitfires and Hurricanes), and to expand the network of radar stations.

While the perception of the existence of an 'air defence gap' was wrong, it provided a timely incentive to switch to a defensive doctrine. The Luftwaffe, whose doctrine remained offensive and whose anti-aircraft gun defences made it over-confident, did not develop a useful radar early-warning system, gave little priority to fighter defences, and failed to prepare an integrated air-defence system. Ironically, an erroneous intelligence estimate which strengthened British fear provided the incentive for changes that allowed the British to survive and win the Battle of Britain, as Professor Wark shows.

The campaign in Norway and the fall of France were further proof, if any was necessary, of British weakness. Defeat in the early phases of the war made it clear in Hinsley's words that '... Germany enjoyed not only the strategic initiative but also

the advantage of good operational intelligence'.³ While British cryptanalytic work was of little help to field commanders during the Norwegian and French campaigns, the Department of the General Staff of the German army provided excellent intelligence support to German Field Commanders.⁴

Success, however, as is well known, can lead to complacency, and it provides a poor incentive for change. German successes on the battlefield, and good intelligence work, concealed many fundamental weaknesses of the German intelligence organisation which could not be discovered while on the offensive. As is well known, the defender depends more on intelligence for his survival than the attacker. German and Japanese intoxicating early successes quickly reduced interest in expanding and improving their intelligence organisations. The 'victory disease', hubris, leads to an underestimation of the enemy and hence to a false sense of security. In war, however, initial success is often counter-productive in the long run. British unpreparedness provided the incentive for improvement. If, during the campaign in France, British intelligence could only provide intelligence to Whitehall and not to field commanders, by the time of the Battle of Britain, it could already provide excellent operational and tactical intelligence.

While German intelligence had established its credibility, the British now had to work much harder in order to prove themselves. Following the Battle of France much time and effort had been invested in centralising British intelligence work and in improving co-ordination, as well as investing great efforts in improving the collection of intelligence, in particular of SIGINT and PR, whose relative importance increased dramatically after the withdrawal from the Continent. Much work was also invested in improving the arrangements for the use of intelligence by the operational authorities.⁵

From the point of view of the intelligence war, the transition period from the Battle of France to the Battle of Britain proved to be the turning point of the war. 'From now on, while the British intelligence system, after its poor start, would slowly succeed in bringing its many parts into closer unity and in obtaining for itself from government and planners an undisputed authority, the much fragmented German intelligence machine would become more divided and less influential as the war expanded.'⁶ British intelligence was at least beginning to improve. What are the lessons for the future? The winner must make greater and more conscious efforts to avoid complacency, must re-examine

his performance and work very hard on identifying the weaknesses that are concealed by his success. Above all, he must not lose his respect for, interest in, and curiosity about his opponent, and must realise that better intelligence and deception provide his defeated opponent with one of his best and cheapest means for improvement. Above all, he must remember Clausewitz' wise words that 'in war the results are never final', and that in the future he may find himself on the defensive, when his dependence on good intelligence will increase dramatically.

The Politics of Intelligence; Intelligence as a Threat; and the Limits of Rationalising Intelligence Work

Intelligence work on all levels is permeated by politics – by parochial bureaucratic interests, the competition between different organisations over budgets and influence, government interference, the interests, position, and character of individual leaders and the like.⁷

The political dimensions and tensions embedded in all intelligence work capture an important part of the discussion of the chapters of Part VII: above all the initial difficulties of co-ordinating the intelligence efforts on the part of organisations jealously guarding their autonomy and resisting change, and instinctively reluctant to share their successes with other organisations. Only against the imminent danger of defeat were the conditions for co-operation finally created; and even then the process required considerable time.

These chapters include many interesting examples of the inevitable political influences on the intelligence process.

R. V. Jones shows, for example, how the Director of Scientific Research of the Admiralty objected to the establishment of scientific intelligence sections in all three Services (Navy, Army, and Air) and in MI6. While he argued that there was in scientific intelligence not enough work to justify the employment of two people, the real motive behind his opposition was the desire of the Director of Scientific Research at the Admiralty to direct all raw intelligence material on naval scientific affairs directly to his own office.

Mr Cox in his paper shows the limited influence intelligence had when it did not support the existing policies and doctrine of

Bomber Command. Indications and reports that the bomber offensive had a poor record of finding and destroying its targets were rejected as faulty interpretation of the evidence, and were perceived as a threat by Bomber Command. Good intelligence was in the case of the Strategic Bombing Offensive often overruled by political considerations. Bomber Command ignored the negative evidence of its lack of success because operational imperatives (i.e., lack of accurate navigation capabilities early in the war) forced it to move to area bombing at night. From the British government's point of view strategic bombing was necessary to demonstrate British support for the Soviet war effort; to show its determination to the US and to mobilise support for a Europe-first strategy; and for domestic consumption, to boost morale by showing that the German population would pay as heavy a price as the British, and that the British were not only on the defensive but right from the start had moved over to a counteroffensive. If intelligence showed that Bomber Command was ineffective in achieving many of those objectives, as Mr Cox shows it did, it made a case by implication that the resources made available to Bomber Command could be used more effectively elsewhere. No matter how accurate such reports were, they were naturally perceived as a threat by Bomber Command, which rejected them and was supported by the politicians, who needed offensive 'action now' regardless of its real military effectiveness. Political logic was more powerful than military effectiveness.

Sir Arthur Harris as Commander of Bomber Command continued to resist for a long while any suggestions to move from city area bombing to the more selective bombing of the German aircraft industry and oil industry recommended early on by the Jockey Committee and the Ministry of Economic Warfare, as Mr Cox indicates. Sir Arthur Harris's powerful personality and position allowed him to resist for a long time any changes in the bombing strategy, despite the contradictory evidence of the intelligence community. Political considerations and personalities often play in war a greater role than rational intelligence analysis.

Indeed, as Professor Wark and Mr Cox show, at times a rational or accurate intelligence analysis could even be counter-productive. As we have seen, faulty perceptions and poor intelligence, leading to the notion of the 'air defence gap' between Britain and Germany led to last-minute changes in British air doctrine, and to the improvement of British air defence. Mr Cox concludes his essay by saying:

... the conduct of the [bombing] offensive was, in the final analysis subject to so many other important factors, operational, political, and eventually personal, that it cannot be said that intelligence was at any stage the final arbiter – indeed one might question whether it should be. Given the fact that intelligence on the bombing offensive of late 1940–early 1941 indicated that it was totally ineffective, at that point the Air Staff, and indeed the government, were sustained by a faith totally at variance with the known facts of the situation. Had they been more inclined to accept the bare facts, Britain would perhaps have sued for peace.

What are the lessons that can be learned from this discussion? Perhaps above all that intelligence and politics (in all its manifestations) cannot be separated. That political considerations often overrule intelligence recommendations and estimates; that only under the most critical circumstances can the intelligence community overcome some of the more blatant manifestations of political interference in its work.

The discussion clearly points to the limits of rational analysis in war, and shows that military effectiveness is not the most important criterion in waging war, and, paradoxically, that mistakes and non-rational behaviour (if not carried to the extreme) can be successful.

The intelligence community *must learn to operate within such political constraints*. Since it cannot ignore them, it must learn to live with them and manipulate them to its advantage, and learn how to 'sell' its product effectively. The politicians on their part must make a conscious effort to listen, even if they disagree and dislike what they hear, and to view intelligence as a source of support, and not of criticism.

Conclusions: Intelligence and Military Operations

Intelligence does not exist for its own sake, it always serves other masters— political and military leaders. Its *raison d'être* is to support military operations. That, however, does not necessarily mean that intelligence plays a secondary role in war; quite the contrary.

Intelligence provides military leaders with information and insights about the enemy that allow them to use the forces at their disposal more economically and more effectively. In this respect intelligence must be considered an important force-multiplier.

This, however, requires the existence of a good intelligence organisation as well as good understanding of its importance, potential usefulness, and limitations. The very existence and effectiveness of intelligence organisations is based on this understanding. It is often too late to develop such an appreciation when a war is already in progress.

The role played by the British intelligence community during the Second World War was a decisive one. Without it the British could not have won the Battle of Britain, the Battle of the Atlantic, or the war in the Western Desert, or launched the successful invasion of North-West Europe at such a low cost.

Conversely, great strength can be wasted without good intelligence. The German and Japanese provide an excellent example of what can happen to a powerful and motivated – but 'blind' – army.

A powerful military and excellent intelligence by themselves, however, cannot guarantee success in war. They only provide the necessary conditions for success. It is critical for the military leaders to understand what intelligence can do for them. Otherwise good armies as well as good intelligence can be wasted.

The Battle of Jutland in the First World War provides us with an excellent example. The British Fleet was much stronger than the German, and British intelligence far superior. Yet, the Admiralty's operation section under Admiral Oliver did not understand how to make use of the outstanding intelligence it received, and as a result missed the opportunity to win another Trafalgar. The Battles of Britain and Midway, on the other hand, demonstrate how an inferior force supported by good intelligence and recognising its value can snatch victory out of the jaws of defeat.

Even the best intelligence is not a panacea – but military power without intelligence is sterile.

Notes

1. F. H. Hinsley *et al.*, *British Intelligence in the Second World War*, 4 vols, London, 1979–88, Vol. I, Chs 5–10.
2. *Ibid.*, Ch. 5.
3. *Ibid.*, pp. 163–4.
4. *Ibid.*, p. 164.
5. *Ibid.*, p. 159; see also Ch. 27 of the present work.
6. *Ibid.*, p. 164.
7. For a detailed analysis see Michael I. Handel, 'The Politics of Intelligence', *Intelligence and National Security*, Vol. 2, No. 4 (October 1987), pp. 5–47.

PART VIII

Air Power, Air Policy, High Command

30

The Air Threat and British Foreign and Domestic Policy: The Background to the Strategic Air Offensive

Malcolm Smith

Introduction

What happened in the air in the Second World War was fundamentally conditioned by what had happened in the years preceding the declaration of war. Large-scale armaments are not produced merely by expressing the wish for them, and the RAF did not spring magically into existence just because the arch-villain Chamberlain was replaced by the hero Churchill in May 1940. In spite of the popular view that the fundamental error of the appeasers was that they underfunded defence, it has to be said that the basic decisions, and the basic investments which were to govern the development of the British air war, were taken in the 1930s. Contrary to myth, Britain by the end of the 1930s was actually spending more on armaments than ever before in peacetime.¹ The RAF, in particular, was actually finding some difficulty in spending the sums allotted to it. The problem was not so much one of lack of finance as lack of industrial potential, a problem extremely difficult to solve in a democratic country in peacetime, but which was actually tackled in the 1930s, in the so-called 'shadow factory' scheme. Lords Swinton and Weir, working in the Air Ministry in the 1930s, were the architects of the shadow-factory system, and the large increase in aircraft output which that scheme produced in the last year of peace, and they deserve at least as much credit as Lord Beaverbrook and the wartime Ministry of Aircraft Production for transforming air potential.²

It was not, however, merely the size of British air power

potential which was conditioned by decisions taken in the 1930s, but its very shape and function. The Strategic Air Offensive which dominated the RAF's contribution to the air war in Europe was the outcome of a complicated attempt to marry up British priorities in foreign policy with what were thought to be the unavoidable strategic implications of this new form of weaponry. Air power was put forward in Britain as a radically new method of war, which would change quite fundamentally the way in which war would be fought – if, indeed, another war had to be fought at all, since it was one of the contentions of some British airmen that air war was so frightening a prospect that it would prove to be the ultimate deterrent.³ On the one hand, air power seemed to fit relatively well into the frameworks of traditional British diplomacy and strategic requirements, apparently offering both a flexibility and a rapidity of response which had not been possible in the pre-air age. On the other hand, in the taut and tense conditions of Europe between the wars, it seemed to make Britain more vulnerable than she had been since that time in the nineteenth century when it had been believed that steam-power had bridged the Channel, robbing her of that long-standing natural defence. Of course, diplomacy and strategic theory are not discrete things, self-sufficient and self-contained; on the contrary, the relationship between the two is symbiotic. It is important to bear in mind, in considering the genesis of the Strategic Air Offensive, both the way in which air power appeared to affect diplomacy, and also the way in which diplomacy affected air power. It is fair to say that the entire strategic stance of Britain in Europe in the Second World War was determined by the relationship between air power and diplomacy that developed in the 1930s.

Britain and France

There were a number of ways in which it appeared that the introduction of air power would make it much easier to maintain the traditional priorities in British foreign policy. The most difficult of all the conundrums facing British foreign-policy-makers in the era leading up to the Great War had been the complicated relationship between European and Imperial policy. Britain's interests appeared primarily to lie in the development of Empire, but not only did Imperial policy necessarily involve her in possible conflict with other European Imperial

powers, but the balance of power within Europe was also seen to be a basic requirement for British defence. To protect this balance of power Britain was prepared, as 1914 has shown, to commit herself militarily to the Continent. But war on the scale that developed in Europe between 1914 and 1918 sucked in all the resources that Britain could possibly mobilise. In the period after 1918, the whole question of the continental commitment was a matter of debate among British strategists, with a whole series of implications for the future of British diplomacy. In this context, the development of air power appeared to offer a way of cutting the Gordian knot that had led to heavy British military involvement in Europe in the Great War, and would probably have the same result in another European conflict.

Basil Liddell Hart was among the most prominent of those who argued that the heavy commitment to the Continent had been hugely wasteful and largely unnecessary. Hart argued that the Western Front had become something of a juggernaut, out of control, the demands of which had made it impossible to utilise fully the alternative strategies that being an Imperial and a naval power made possible.⁴ If there was another war in Europe, Hart argued that any Field Force sent to the Continent should be kept as small as possible, and highly mobile, merely a shock force which would be, necessarily, heavily reliant on some large-scale continental army to take the brunt of the war effort.

The problem with Hart's point of view, as far as some of the airmen were concerned, was that this still assumed that there must be a land commitment to the Continent of some kind. Though the airmen at first defended the Army against attacks on its European role, many airmen came to doubt whether this role was either necessary or wise. It was not wise, because to commit British forces to Europe had the inevitable corollary that, to a greater or lesser extent, they would come under the strategic direction of the nation on whose soil they were fighting. This was a significant development of the argument about the continental commitment, because it cast doubts on the extent to which Britain should actually be committed to European allies in defending her interests on the mainland: had not British primary interests been subordinated to those of France in the Great War, simply because the British Army was fighting on French soil, and because the strategic imperatives of trench warfare had meant that only if the French held their line could the British hold theirs? It was not wise, either, because in a new

conflict enemy air power would almost certainly prevent a British Field Force's getting ashore on the Continent. It was not necessary to make a commitment in Europe, the airmen argued, because aircraft could do the job a Field Force was designed to do – protect the Low Countries, the Northern European coast – far more efficiently and flexibly than could a Field Force, and the next day (as it were) they could be defending British interests in, say, the Middle East. They could perform these tasks, moreover, from bases in Britain, and would therefore not be answerable to other nations.⁵

This may sound like dangerous strategic heresy – indeed it was; but in the heady days of early air-power development in Britain, anything seemed possible. The development of longer-ranged bombers appeared to provide the strategic option of a centralised, rapid-deployment force, operating from Britain over Europe and the Middle and even the Far East. The only capital commitment overseas would be the development of the Imperial air routes, the bases for which would anyway be in British colonial territory. In 1935 and 1936, this notion was given added point at the time of the Abyssinian crisis. The Royal Air Force planned, if hostilities broke out with Italy, to bomb the industrial regions of Northern Italy.⁶

Unfortunately, given the short-ranged aircraft that were all that were available at that time, this could only be done from bases in Southern France. Understandably, the French were none too happy about this – because it exposed them to the risk of retaliation, among other things – and the British airmen were forced to concede. The immediate result, however, was the issue of the specifications for long-range heavy bombers that could fly non-stop to the Mediterranean.⁷ These specifications were, in time, to produce the Stirling, Halifax and Lancaster bombers with which Bomber Command was to fight the Second World War.

The diplomatic implications were far-reaching, particularly in a period when the British considered that the French were being unnecessarily adamant in their attitude towards reaching some form of *rapprochement* with Germany. Though it still needed such an understanding between France and Germany to prevent a war in Europe into which Britain might well be drawn, the British might not any longer need French help to protect British interests, should war occur. The British need not in turn, therefore, concern themselves too much with French susceptibilities. They could drive for appeasement, and let the French

hang on to their coat-tails. I cannot pretend that I believe that this was why Chamberlain took such a high-handed tone in the framing of the appeasement policy, but I do suggest that the development of air power undermined the strategic rationale, and therefore the diplomatic rationale, of the *entente cordiale*. I think it is fair to say that the *entente* had never been more than a strategically unavoidable burden, as far as Imperially-oriented British diplomats were concerned, and if air power could give Britain greater strategic and, therefore, diplomatic flexibility, so much the better. Though this possibility was only a prospect in the inter-war period, it was one that had begun to alter the realities behind diplomacy.

Throughout the 1930s the decision on whether a considerable land commitment should be made to the Continent in the event of war was repeatedly shelved, and with it the idea of providing help for allies on the mainland. Priority was given instead to the RAF and the air defence of Great Britain. Clearly, this prioritisation was not the result simply of a belief that Britain's continental allies did not matter any more; it was even more the result of the overriding fear of air attack in Britain in the 1930s. But this also downgraded the importance of Britain's continental allies, and helped to reshape British diplomatic priorities. The whole concept of the Field Force was founded on the principle that the integrity of France and the Low Countries was basic to British security. The RAF's argument for priority for the air defence of Great Britain implied an increasing doubt about the priority that should be allotted, *per se*, to Britain's continental allies. The very notion that the defence of Britain was something separable from the defence of British allies on the Continent in itself constituted a very considerable movement from the strategic and diplomatic priorities that had taken Britain into war in 1914. The airmen's argument was that, though a successful German invasion of Western Europe would make an air attack on Britain all the more dangerous – by providing bases nearer to targets – such an invasion need not in itself be decisive, as long as all available air resources were concentrated in a centralised air system. Defeat on land in the West did not mean the defeat of Britain, and thus the defence of her continental allies was not Britain's rock-bottom strategic priority.

By 1939, however, appeasement had taken Britain too far along the tempting avenue of diplomatic self-reliance: the decision to confront Germany with a united Anglo-French front after the occupation of Slovakia also involved a decision by the

British to 'stiffen French resolve', as the Foreign Office put it, in the form of a clear continental commitment, a doubling of the Field Force. It was a decision which threw the Air Staff into some confusion, assuming as they did that they had won this particular battle over the allocation of resources and strategic priorities. Nevertheless, the air defence of Great Britain remained the priority in defence, and it was accepted that the continental commitment should not endanger the minimum requirements of Fighter Command at home. There was, therefore, no question what Britain would do if France were faced with defeat on land, and a grimly ironic germ of truth in the German propaganda message that 'Britain would fight in France to the last Frenchman'. Fighter Command's Dowding was successfully to dig his heels in when Churchill wanted to commit more fighters to France in 1940, one of the very few examples of a military commander in the Second World War convincing Churchill that he was wrong.⁸

I hope that this part of my discussion may also explain why it was that Bomber Command seemed to play so small a part in the land battle in 1940. Though the Air Staff was forced by circumstances to make plans for bomber support of British and Allied forces in the event of the German land invasion, they framed plans only as a subsidiary element in their larger plan for independent air action in the Ruhr.⁹ As a whole, the British strategic air plans were to take very little account of the fact that Britain might have continental allies. The airmen tended to proceed as if the French did not exist. The one beneficial spin-off of this attitude (if it can be called 'beneficial', in the tragic circumstances) was that when the unexpected French defeat occurred in 1940, the RAF was the only one of the defence forces in Britain which had strategic plans relevant to the new situation, even if it did not have the theoretical or the material wherewithal to carry out those plans.

Britain and Germany

If, on one level, the advent of air power tended to simplify British attitudes to Europe or – to put it a little harshly – provided a series of excuses for downgrading the largely unpopular French connection, in other areas the advent of air power vastly complicated the tasks of the foreign-policy-makers. On the theoretical level, air power appeared to be a

uniquely aggressive medium of warfare, and one that could not easily be fitted into the overall pattern of concession and conciliation that characterised British foreign policy between the wars. As a result, diplomacy was to make certain demands on air power that the RAF believed flew in the face of acceptable military principles.

The introduction of air power produced a new brittleness in international relations generally, the result of the diplomatic imperatives that air power seemed to imply. British air theorists argued that no defence was possible against air attack, except counter-attack. Given the vast cubic airspace available to incoming bombers, given the speed with which a bomber attack could be mounted and the unpredictability of its targets, it was inconceivable that a system of fighter defence could be mounted which would defend all possible targets. Even if such a system of constant standing patrols could be mounted, the airmen considered it highly unlikely that fighters could destroy bombers when they found them. Before the days of radar, before the development of the single-seat monoplane fighters and the system of fighter control which Fighter Command was to develop in the 1930s, it was probably largely true that the bomber would 'always get through'.¹⁰

However much the heads of the other Services might pour scorn on this basis of British air-power theory, governments had little option but to accept the best available professional advice on this subject; it was to take an extremely daring politician to take on the Air Staff on their own ground, as Sir Thomas Inskip was to do, but not until late in 1937. The airmen further argued that the amount of damage inflicted would be enormous, destroying the industrial infrastructure within a matter of days. Britain, moreover, was particularly vulnerable to such attack, with the Channel – hitherto the best guarantor against invasion – now acting as a screen preventing early warning of incoming bombers. London was just fifteen minutes flying time from the Channel coast, and all the other major industrial and urban targets were within easy reach of continental air forces. The only possible riposte, the Air Staff argued, was to build a strike force of such strength that it would deter any potential attacker through the threat of overwhelming retaliation, the threat of an attack that would simply ignore the defending air force and smash the economic and social system.¹¹

The question that this posed for foreign-policy-makers was an acute one. The particular vulnerability of Britain to air attack

made it pretty clear that Britain would be well-advised to avoid first strike. Yet, clearly, Britain could not simply sit back and allow a potential adversary to gain a strategic advantage that might make her even more vulnerable to air attack. Even minor frontier changes, if they lessened the distance between a potentially hostile air force and its targets in Britain, demanded a disproportionate increase in British air strength to offset Britain's increased vulnerability. It was no doubt this point that Stanley Baldwin had in mind when he told the House of Commons on 30 July 1934 that, in the air age, 'when one thinks of the defence of England, one no longer thinks of the White Cliffs of Dover; one thinks of the Rhine'. Air power, in other words, virtually demanded the strict containment of a potential adversary. On the other hand, the rationale of British diplomacy between the wars – indeed, at virtually any time until this point – was quite different. The containment of Germany was considered neither workable nor just, and British diplomacy aimed at stabilising Europe by producing a package of agreements on territorial and other issues, which would pacify Germany without unduly upsetting France. The remilitarisation of the Rhineland in 1936, for example, made Germany easier to defend and, therefore, made Britain more difficult to defend. The logic of the air-power case dictated either resistance to the remilitarisation, or the building of a much larger air force to offset the change in the strategic balance that resulted. In fact, Britain did neither, not least because she had already ceded remilitarisation in private, and was at the time working on a package to grant remilitarisation in return for guarantees from Germany.

It was certainly quite inconceivable that the British would be prepared to unleash a massive air attack in order to prevent the Germans 'walking into their own backyard', as one contemporary put it. The same was true of the *Anschluss* and of the Czechoslovak problem in 1938. British diplomats were looking to establish a new equilibrium in Europe, to replace that destroyed by the Great War and the peace settlements that followed. Until such a workable equilibrium had been reached, to apply a policy of containment to Germany – such as that demanded by the air-power theory – was simply dangerous; it might tempt Germany to break out, and thus in turn force Britain to defend a European status quo that diplomats knew to be unfair, unstable, and therefore unworkable. It was not simply that contemporary diplomats were scared by Britain's apparent vulnerability to attack, though they justifiably were; it

was more that the strategic logic of the air-power case was simply irrelevant in the international conditions of inter-war Europe. Air attack on the scale predicted by the Air Staff was, anyway, an over-reaction to virtually any crisis that might emerge: to risk using air power militarily, a nation had to be pretty certain that a cause really was worth the kind of destruction that air war might produce, a cause moreover that could really be saved, as Chamberlain put it at the time of the Czechoslovak crisis. The airmen's contemporary over-estimate of the effects of air attack, in other words, in effect gave Germany a great deal of latitude before Britain might actually be prepared to intervene. If the capability claimed for air power had been couched in more moderate (and more realistic) terms, then Britain might possibly have been prepared to move earlier than she in fact did. She might at least have been prepared to offer a graduated military response, but the total commitment to air power demanded by the idea of the knock-out blow wrecked this possibility. In this sense, the airmen did British foreign policy a great disservice in the inter-war period.

The Air Rearmament Schemes and Appeasement

Rather than accepting the implications of air power, British diplomats attempted to subvert the threat from the air in a series of package deals offered to appease Germany, including the possibility of the abolition of air war. The result was that Britain built a bomber force in the 1930s, but one shaped in ways which the Air Staff thought militarily inadvisable, in ways which were designed to make air disarmament easier to achieve rather than to make it possible actually to fight an air war. British air-disarmament proposals first appeared in the MacDonald Plan presented to the Geneva Disarmament Conference in 1933, a genuine attempt to allay French worries over the question of the Germans' right to arms by simply abolishing the form of armaments that was creating most trouble. The French were understandably cynical about a plan that allowed the British to keep air power for imperial policing, and the row which developed over the timetable for abolition led to Germany's second and final departure from the Geneva Conference.¹² Although the proposal for air disarmament was itself the cause of much friction, however, the British Foreign Office pursued it in the post-Geneva attempt to appease Germany.

There can be no doubting the commitment of the appeasers to disarmament in the air, or their belief that the fears that the very existence of air power created were refuelling the frictions that the arms race had fired before 1914. Sir John Simon, Foreign Secretary in the early 1930s, wrote about the possibility that air power would continue to develop: 'it would be an atmosphere of hostility, if not hostilities, which will militate with full force against that financial and economic recovery which is essential not only to peace but to the very existence of civilisation. And the number of years for which real hostilities can be staved off would, in all European opinion, be doubtful.'¹³ The Air Ministry, on the other hand, was far from convinced; the Secretary of State for Air at the time of the Geneva Conference, the Marquis of Londonderry, was in the ostentatious and provocative habit of turning up to Geneva in a bomber! Nevertheless, every major package of proposals put by Britain to Germany in the ensuing years contained some form of air-disarmament proposal. And when rearmament began in 1934, and through to 1937, expansion plans for the RAF were based on the assumption that the role of rearmament was to help to secure international agreement rather than to prepare for war as such.

I emphasise this point because so many of the critiques of British rearmament policy in the 1930s are based on the assumption that the appeasers were making inadequate preparations for war. In fact, they were well aware that there was a distinction between the expansion programmes they were authorising and what would be required in the event of war; virtually every paper from the defence departments pointed out the distinction to them in meticulous detail. The immediate requirements of diplomacy, however, demanded a non-aggressive approach, a conciliatory stance which might tempt Hitler back to the conference table; any large-scale build-up, of air arms in particular, could jeopardise the delicate chances of negotiation. Not until early 1938, when the cost of maintaining non-aggression as a basis for rearmament was becoming astronomical, were decisions taken about how Britain should prepare for war. Right or wrong, these were the parameters of British diplomacy in the 1930s, and it does the study of history no good at all to simplify the aims of the appeasers in order to vilify them more thoroughly. Wrong-headed the appeasers may have been, but air-power theory meant that the rationale of British air policy through most of the 1930s had to be extremely complex.

Air expansion from 1934 to 1937 was not based on what

Britain required for security from air attack, but on numerical parity in bombers with the German Air Force. Britain's relative vulnerability was not taken into account. Expansion was designed to show that Britain would not allow herself to be outbuilt in such a crucial field of weaponry, but on the other hand that Britain had no aggressive intentions, so the Nazis might as well sit and talk about their grievances and reach agreement. This dictated piecemeal and unpredictable additions to the expansion programme, based on changing estimates of the size of the German Air Force at any one time. The Air Ministry would have preferred a longer-term programme designed to give security by 1939; but the diplomats needed both immediate and running parity to back their negotiations. The result was that the Air Ministry was forced to take whatever bombers were immediately available, simply in order to keep up front-line strength. The Fairey Battle, for instance, was known to be operationally inadequate before it even flew, yet its availability for large-scale production led to large-scale orders. This stop-gap equipment policy also had the effect of delaying production of newer and more promising types in order to maximise the production of existing types. By 1939, indeed, Bomber Command actually had more squadrons of obsolescent or otherwise inadequate aircraft than had even been authorised, so desperate had become the need to sacrifice quality for quantity to retain numerical parity in bomber strength.¹⁴

At the same time, the development of newer types more suitable to changing conditions of war had only been delayed, not abandoned. The long-range heavy bombers were at least allowed into the developmental pipeline, even if they were not that high on the list of priorities. Already by 1937, however, it had become clear that the sheer cost of maintaining the parity policy (which was, anyway, not even designed to give Britain security, but simply as a short-term diplomatic tool) was becoming unacceptable. It was at this point that the Minister for the Co-ordination of Defence, Sir Thomas Inskip, decided to take on the Air Staff on the question of the supremacy of the counteroffensive in air warfare. Looking for real priorities in preparation for the possibility of war, Inskip found for fighter defence rather than the counteroffensive.

Having had their case for an overwhelming bomber force rejected in the previous years in favour of a more limited deterrent to tempt Hitler into negotiation, the Air Staff now saw their basic theory of war called into question. In truth, it was a

fearful risk that Inskip was taking. It meant that full priority had to be given to Fighter Command, in the teeth of professional opposition, in the hope that the still untried method of radar detection would in fact give the new fighters the edge over a German bomber force now thought capable of carrying 3,500 tons of bombs a day, which might inflict up to 58,000 fatal casualties. We now know, of course, that the Luftwaffe was incapable of anything like that effort, but such were the cumulative effects of successive over-estimates of German air capability by the Air Ministry, fed by careful Nazi 'leaks' and some hysterical secret-service information. Even when the operational use of the Luftwaffe in war allowed more rational estimates of German air strength to be made, the Cabinet Office in June 1940 was still predicting 18,000 fatal casualties a day for the Blitz.¹⁵

It might be said that the major reason why the Air Staff did not get the bomber force it felt it needed in the 1930s was, to a large extent, its own fault. Its attempt to win major financial apportionment by drawing apocalyptic pictures of what the next war would be like only succeeded in reinforcing politicians' convictions that, in that case, the next war must not happen, and everything possible must be done to abolish a barbaric method of warfare. As long as it attempted to fit itself into the traditional framework of British strategic requirements, air power was successful. The case for substitution of air power for land forces in the policing of Empire, and the case for the development of long-range air power to increase British freedom of action, were both taken on board as methods by which Britain could fulfil more efficiently her unavoidable commitments. It was when the proponents of air power tried to assert new commitments for Britain, merely because of the existence of aircraft, that they came unstuck. The acceptance of the notion of the air deterrent would undoubtedly have produced a very different foreign policy, as it was to do after 1945. Indeed the development of the Great Deterrent theory after 1945 relied a great deal on what was assumed to have gone wrong in the 1930s.

But it is not clear that a foreign policy based on the air deterrent would have been any more successful in the 1930s than appeasement in fact was. There seems to me little reason to suppose that Hitler would have backed down if the British and the French had moved in the case of the Rhineland, Austria or Czechoslovakia. And if the air deterrent had been tried and had failed to prevent war, then the results might have been even

more devastating than they in fact were. Where would a massive series of air attacks have got Britain in 1939, when even the effects of the Strategic Air Offensive after five years of combat experience are matters for debate? Certainly, the theoretical weaknesses that underlay the Air Staff theory of war would have been exposed that much earlier. As it was, these theoretical weaknesses were not discovered until the second half of the war; by this time, Bomber Command had got the long-range bombers it said it needed, but it still could not act as the strategic stiletto it had promised to become. The net effect of British diplomacy in the 1930s was to provide a bomber force which could at least do something relevant in the strategic circumstances that prevailed after 1940. The fact that this relevant strategy could not be carried through effectively had as much to do with faulty military reasoning as it had to do with faulty rearmament. Left to their own devices, the Air Staff would not even have prepared adequately for the Battle of Britain.

The Air Threat and the Domestic Front

The figures given above of expected casualties from air attack may give some indication of the depth of disquiet that many politicians felt about the possibility of renewed conflict with Germany. Aerial assault of civilian targets was actually designed to bring about not just material dislocation of the industrial infrastructure, but also to undermine the will to war of the population. In the wake of the Great War airmen could rationally argue that traditional forms of warfare were bound to produce the attritional stalemate that had characterised the Great War, but that the test of political and social institutions that total war produced, a test that had taken years to break Russia and Germany, could successfully be reproduced in just a matter of weeks, if not days, by the use of air power. Aircraft could literally leap over the trench stalemate and attack directly those innately vulnerable economic and social targets upon which the military shield ultimately depended.

There was, however, only the flimsiest direct evidence on which to base such a case. To find out how vulnerable oil plants might be to aerial attack, for instance, the experts were actually reduced to throwing paper darts at a model of the Billingham ICI plant to calculate how many direct hits there might be: they concluded that it was 'very vulnerable'.¹⁶ The basis on which

such assertions were made was in fact ideological as much as it was factual. In a period when gross economic dislocation was part of everyday experience, as the result of intangibles such as the Gold Standard, the terms of trade and world demand, the idea that tons of very tangible TNT falling from a great height would have a quite catastrophic effect on the economy made a great deal of sense. In a period, too, when the effects of the Great Depression were widening class barriers, the potentially disastrous effects on social unity of air attack seemed real enough. In Britain, for a generation of politicians who had given the greater part of their careers to ensuring that the effects of the Great Depression did not spill over into overt class warfare, air warfare was a particularly appalling prospect. Indeed, most of the preparations for civil defence made before the war broke out were based on the assumption that the primary role of government on the home front in a bombing war would be the political and social control of a panicking population.¹⁷

This was not, however, simply the view of the political élite. British popular culture of the inter-war period abounds with images of the catastrophic social and economic impact of the 'next war'. And the 'next war' almost always meant a war from the air.¹⁸ The point I wish to make here is that the topic of air war in Britain between the wars was by no means simply the preserve of 'the great and the good': its implications reached deep into the economic, the social and even the psychological roots of the nation. In fact, the enormous overstatement of the likely effect of air power was to make it a great deal easier to live with when it actually happened.

This raises the question why the airmen in Britain continued in their belief that their own strategic air offensive would shatter Germany, when the German offensive had clearly not shattered Britain. The answer is that the British airmen believed that the Germans had simply not tried hard enough. They reasoned that the relatively light bombers that the Luftwaffe employed in 1940 and 1941 had a bomb-carry which could not begin to match the load of the British heavy bombers in the pipeline. Indeed, it might be said that the RAF's offensive, in combination with that of the USAAF, was quantitatively so much more massive than that of the Luftwaffe as to amount to a qualitative difference. It was also believed that the political changes that had occurred in Britain in May 1940, the formation of the Churchill-Labour coalition, had created a degree of national unity which had become part of the national armoury against the bomber: taking

the war to the German people, on the other hand, would undermine the gloss of national unity that the Nazis had hoped to produce in the early years of the war.

Just as important as the psychological gearing of the nation to the prospect of a bombing war was the economic mobilisation. The British aircraft industry had survived on a starvation diet of military and civilian orders in the 1920s, and found it difficult to gear itself to what soon became a surfeit of military orders in the 1930s. They were competing for fitters and mechanics not only with RAF recruitment but with the developing motor-car industry, and with the government ruling that rearmament should not interfere with normal peacetime trade. By February 1939, indeed, the labour situation in the aircraft industry was becoming desperate, and only the outbreak of war and labour direction saved the aircraft-production programme from an irretrievable breakdown due to labour shortage. Just as serious was the lack of experience of the industry in the problems caused by large-scale production of larger aircraft. Geared to small orders of high-quality aircraft, designers found it difficult to build mass-production characteristics into their newer designs, and managers found it equally difficult to produce satisfactory production schedules.¹⁹

This had the most adverse effect on the air-expansion programmes. Barnes Wallis's geodetic design for the Wellington bomber, for example, proved extremely difficult to produce and required a great deal of labour. In spite of the great military success of the aircraft, largely because of the strength that geodetics gave it, it was because geodetics created such production problems that the Air Ministry did not order a stretched version of the design to accompany the Sterling, Halifax and Lancaster in the heavy-bomber generation.²⁰

Attempts to speed up production by missing out parts of the development stage were fraught with grave risks. The service trial of the Armstrong Whitworth Whitley, for example, was only the most memorable fiasco of many: the aircraft was inherently unstable and could not fly straight; the nose turret would not move in flight because of wind pressure; nobody could see out of the mid-upper turret; the tail guns would only fire in a certain position; the aircraft crashed on landing.²¹

Many aircraft that later became great successes were lucky to get off the drawing board, and survived the most appalling muddles. The Avro Manchester, for instance, was the great white hope of the Air Ministry through the second half of the

1930s. Production difficulties, however, delayed its appearance; and when the twin-engined airframe was finally ready, the new large engine that had been produced for the aircraft proved hopelessly underpowered. Through sheer luck, large numbers of Merlin engines had recently become available through cancellation of another aircraft type. The Air Ministry and Avro simply changed the design of the Manchester, lengthening the wings so that it could take the four Merlins that would be necessary to power it, and renamed it the Lancaster. The Ministry and the industry were not always so lucky: aircraft like the Battle and the Harrow survived only because they were available for quantity production at a time when the front-line bomber strength of the RAF was the supreme necessity.²² The shadow-factory scheme, a grouping of factories to produce the required aircraft irrespective of who had designed them, was the nearest Britain could get in peacetime to the necessary rationalisation of the aircraft industry, and provided the framework on which the Ministry of Aircraft Production during the war could develop Britain's air effort relatively painlessly. In fact, the 'blood, sweat and tears' of the British effort in wartime were already being shed in the all-important preparations of the 1930s.

Conclusion

I have talked very little about the war itself. My point is that most of the basic decisions that were to shape the British air war had been taken before the war began. It took up to six years to get a new aircraft type into service in the 1930s and 1940s, and once the RAF had become committed to production of a certain type, based on what the force assumed would be its future operational requirements, there could be no going back. In fact, operational requirements had changed very rapidly in the nervous reaction to the developing European situation in the 1930s. The Air Ministry got its long-range bombers on to the production schedule, but in the meantime it would have to fight the first half of the war with aircraft that had been designed to deal with operational requirements projected in the early 1930s, when the prospect of a Second World War was still a somewhat distant nightmare. As a result, it was not to be until 1944 and 1945 that the whole theoretical basis of British air power – the notion that air power could win the war virtually on its own, and without the need to defeat the enemy air force in being –

could be exposed as faulty. Until the latter stages of the war, it was possible to argue that Bomber Command was not properly equipped because of a faulty rearmament policy, that the fall of France justified the long-range independent strategy, that the German air attack on Britain was no yardstick against which to measure what Bomber Command would be able to do to Germany. But it was, after all, a fully-equipped and operationally-experienced Bomber Command that was brought to the very edge of defeat over Berlin. It will not do to blame the pre-war period for everything that went wrong in the war.

Notes

1. Not that they necessarily spent enough money, or on the right things. See R. P. Shay, *British Rearmament in the Thirties*, Princeton, 1977, and compare with G. Peden, *British Rearmament and the Treasury 1932-1939*, Edinburgh, 1979.
2. See Malcolm Smith, 'Planning and Building the British Bomber Force', *Business History Review*, 54, 1980, pp. 35-62.
3. One of the most credible of those arguing this case, especially at the time of the Geneva Disarmament Conference, was J. M. Spaight, for instance in *Air Power and the Cities*, London, 1930. See also G. H. Quester, *Deterrence before Hiroshima*, New York, 1966.
4. E.g. B. Liddell Hart, *Paris, or the Future of War*, London, 1925 and *The British Way in Warfare*, London, 1932.
5. The Air Staff attack on a need for an Army Field Force is contained in Public Record Office file AIR 9/8. For a fuller development of the airmen's view on this, see Malcolm Smith, *British Air Strategy between the Wars*, Oxford, 1984. For the soldiers' response, see B. Bond, *British Military Policy between the Two World Wars*, Oxford, 1980.
6. See COS 157th, 'Comments by Chief of the Air Staff', 5 December 1935, PRO, CAB 53/5.
7. PRO, AIR 9/77.
8. The most thorough accounts of Dowding's stand against the further erosion of his force in 1940 are to be found in B. Collier, *The Defence of the United Kingdom*, London, 1957, and R. Wright, *Dowding and the Battle of Britain*, London, 1969.
9. The development of air plans for the Battle of France are in PRO AIR 9/105, /180, /80. See Smith, *British Air Strategy*, Ch. 9.
10. Stanley Baldwin, House of Commons Debates, 10 November 1932.
11. Smith, *British Air Strategy*, Ch. 2.
12. R. A. Chaput, *Disarmament in British Foreign Policy*, London, 1935.
13. PRO, CP30(33), Memo by Secretary of State for Foreign Affairs, 10 February 1933, CAB 24/237.

14. Smith, *British Air Strategy*, Chs 4-7.
15. PRO, COS 603, 'Memo by Committee of Imperial Defence Home Defence Sub-Committee, Estimated Scale of Attack on Britain', June 1937, CAB 53/32; Note to Prime Minister, 9 July 1940, PREM 4/3/25.
16. PRO, Sub-Committee on Protection of Important Points against Air Attack, 'Report on visit to Billingham ICI Plant', July 1936, AIR 9/79.
17. See T. H. O'Brien, *Civil Defence*, London, 1957; R. Titmuss, *Problems of Social Policy*, London, 1950.
18. P. Miles and M. Smith, *Cinema, Literature and Society, Elite and Mass Culture in Britain between the Wars*, London, 1987.
19. For some of the many problems facing the British aircraft industry, see P. Fearon, 'The British Airframe Industry and the State', *Economic History Review*, 27, 1974. See also Fearon's 'The Formative Years in the British Aircraft Industry, 1913-1924', *Business History Review*, 43, 1969 and 'The Vicissitudes of a British Aircraft Company: Handley-Page between the Wars', *Business History Review*, 52, 1978; R. Higham, 'Government Companies and National Defence: The British Aeronautical Experience', *Business History Review*, 39, 1965, and also Higham's 'Quality vs. Quantity: The Impact of Changing Demand on the British Aircraft Industry', *Business History Review*, 42, 1968.
20. PRO, AIR 6/27.
21. PRO, AIR 6/27.
22. See Malcolm Smith, 'Planning and Building the British Bomber Force'.

31

French Air Policy in the Inter-War Period and the Conduct of the Air War against Germany from September 1939 to June 1940

Lucien Robineau

In the same way as it is easy, after the cessation of hostilities, to blame the general who failed to achieve victory, so there was a great temptation in France, after the summer of 1940, to blame the Air Force for defeat, since people were convinced that the enemy victory was due to his air forces. However, they convinced themselves that it had only been a question of numbers, and they tried at first to exaggerate the ratios.

It has been demonstrated in every conflict since air forces appeared on the battlefield that victory is no longer conceivable without first achieving air superiority. Air Force regulations were based on this fact since 1937, and the 'Instruction sur l'emploi tactique des grandes unités aériennes' (Directive on the Tactical Employment of Major Air Force Units) dated 31 March 1937 made this perfectly clear:

The task of the Air Force in war is, by dominating the enemy, to create, maintain and exploit a situation enabling it to utilize the air for all military, political and economic objectives considered advantageous to the conduct of the war, and to prevent the enemy from using it for the same objectives. When such a situation is created, there is air superiority . . . General and permanent air superiority is exceptional. The whole art of the 'Haut commandement aérien' (Air Force High Command) lies in the ability to establish air superiority over the enemy at the desired time and place.

However, such a situation cannot be conjured up by the magic of texts. Field Marshal Montgomery, who also ranked air

superiority first, ahead of organisation, among the preconditions of military success, was only right in so far as the selected organisation does not interfere with the combined efforts aimed at achieving air superiority. For every war is consequential, and the outcome of a battle – however painful it may sometimes be – is a turning point. The Battle of France, which went on for 45 days in May and June 1940, signified not the end of eight months of phoney war, but of a policy that had been pursued for twenty years.

Almost half a century after the event – taking care not to pass any a posteriori judgements, rendered too easy by subsequent knowledge of the facts and situations – we can attempt to narrow down the general conditions governing French conduct of the air war, i.e. to find out what strategy the 'Commandant en chef des forces aériennes' (Commander-in-Chief of the Air Force) had elaborated and applied, taking into account the organisation of defence at that time and French foreign and economic policy, as well as the essential Alliance concluded with the British. However, it is not possible to understand the way in which the air war was conducted without first examining it in the light of France's general air policy: the determination of the role of military aviation, the drawing-up of an operational doctrine, the policy on the provision of resources and, above all, the management of the aeronautical industry and the planning of its production.

The conduct of the air war itself – which was the issue or, at any rate, the consequence of the decisions taken in these different fields throughout the inter-war period – must be examined from the point of view of an analysis of strategy and an understanding of the resolutions adopted with a view to mastering operational circumstances, taking into consideration the general situation, the potential created by the resources and the latitude allowed by the organisation.

To accomplish this project, there is no lack of archive material, and its abundance may even constitute a stumbling-block: there are almost 60 cardboard boxes of documents from the 'Grand Quartier général aérien' (Air Force Headquarters) at the 'Service historique de l'armée de l'Air' (Air Force Historical Office); there are also the archives of the various operational commands – in particular those of the zones of air operations – and the private archives of Guy la Chambre, General Vuillemin, General Jeanaud and General Mendigal. In this context, the most valuable information was provided by war diaries from the various head-

quarters and, above all, by those diaries in which all the general and fragmentary orders of the 'Commandant en chef des forces aériennes' as well as his special directives are recorded. Just as important was the correspondence between this high command and General Gamelin, and later General Weygand, as well as the correspondence of General Georges, the commander of the north-eastern theatre (later Front), which gives a fairly accurate idea of what relations – sometimes opposition concerning air manoeuvres – were like between the Army and Air Force commands. The reports drawn up after the armistice by unit commanders on the orders of the 'Inspection générale' 'with a view to looking for the lessons to be learned from the war' are not without interest, in that they confirm other facts from the point of view of the performers. However, they often reflect a certain passion, which leads to unqualified judgements that are none the less well-founded . . .

However, this wealth of documents is very incomplete, for entire weeks, in which there was much activity, appear to have been forgotten. In addition, in such a short study of such a vast subject, one can only highlight a few selected aspects, leaving many other points unconsidered. Thus we have deliberately limited the scope of this study of the conduct of operations to the period from 3 September 1939 to 25 June 1940, and we shall not proceed with an analysis of phenomena, which, while very important and meriting much attention, can be set aside from the problems under discussion here. They include:

- the conduct of air operations against Italy, which did not enter the war until 10 June, by which time it was already over; the orders issued for operations against it were in all respects similar to those issued against Germany, with the same tactical precautions and the same guiding principles and without more resources. At the most, it should be mentioned that this was the imaginary pretext for a 'brutal and powerful offensive against Southern Italy, the Islands and Libya', which was behind the order given by General Vuillemin on 17 June to deploy the bulk of French combat aircraft in North Africa.
- the plans for external operations, i.e. Finland, Scandinavia, the Balkans and the Caucasus. These operations were the subject of much study, which produced very detailed dossiers and very elaborate logistic preparations. They only serve to show the extremely wide range of matters which had to be dealt with by those in charge. Even though the 'Commandant

en chef des forces aériennes' had plans drawn up and ordered a (modest) deployment in Finland and Norway, which did not extend beyond British territory, he remained faithful to his guiding principles and tried not to waste the resources which he thought necessary for the principal theatre in secondary peripheral adventures.

- the employment of British air forces in the conduct of the air war. Of course, a study of the procedures which led to the launching or carrying out of the missions which the RAF was asked to carry out for the French command would have confirmed the complexity of the operational organisation employed. There are two important points to be made here: first, the RAF largely fulfilled its contractual obligations in the north-eastern theatre, given its resources and the general strategy of the British government. It sometimes intervened in extremely dangerous conditions, and, for example, out of the 65 aircraft employed in a single day's operations on the Meuse it lost 35; second, there is no reason to add strength of French and British aviation for the purpose of comparing force systems. The bulk of the RAF remained stationed on British territory, from where it was later able to fight another battle in a decisive manner.

French Policy in the Field of Air War

The outcome of a future air war will probably depend more on the quality of those who were previously in charge of the technical, tactical and moral preparation of the Air Force than on the quality of those who will actually command its various elements in time of war. The drawing up of a doctrine and everything that was consequent upon it, *matériel* programmes, construction, testing, utilisation of funds, organisation, mobilisation of industry, tactical and strategic employment, would thus appear to be fundamental and will have a bearing on future success or failure.¹

wrote General Hébrard in 1937. In September 1939, the Air Force which was going off to war had only been in existence for just six years. It grew from the Army, under whose direction military aviation had conducted air operations during the First World War. It broke with the Army in an acrimonious war of secession, which was both long and difficult, and it was only able to achieve its independence by making essential concessions – which it considered provisional – on the operational

employment of the air arm. Its combat effectiveness in the face of a challenge by the enemy is the synthesis of all these compromises it had to make on doctrine and organisation, as well as the initial compromise on the structuring of its resources.

Three air ministers are the fathers of this Air Force and took charge of its continual reshaping. They were: General Denain from 1934 to 1936, Pierre Cot from June 1936 to January 1938 and Guy la Chambre from January 1938 to March 1940. Of course, each of them began by administering the legacy of his predecessor, which was also based on a general policy and the aeronautical industry.

A Policy Based on the Alliance with Great Britain

The general policy, whose principles were also going to have a great influence on the actual conduct of the war, had one constant factor: France had realised since 1919 that, although she was pursuing a pacifist policy, she would have to wage war against Germany once again, since the American attitude towards the peace treaties offered no real guarantee, and thus undermined their substance. She was also aware that she would not be able to do it alone. Even the outcome of the preceding war had been determined by the intervention of the United States, who had sent in almost two million soldiers by November 1918; whereas the French forces only represented 41 per cent of the Allied forces at that time. And had not Joffre said, at the conclusion of peace, that in a future war the French armies would be no more than the bridgehead for the Anglo-Saxons?

However, in the 1930s it was almost impossible to count on direct support from the United States, despite the active sympathy shown by President Roosevelt as early as 1938. The coalition was a necessity, but which countries should it include? England, naturally; Italy, perhaps, until 1936; Poland, Rumania, Czechoslovakia and especially Russia, who would be able to represent a real counterweight to German ambitions in Central Europe and to make, in particular (and Pierre Cot remained convinced of this), a significant contribution in terms of air power. While several French governments, although of different political persuasions, attempted to conclude a Franco-Russian alliance by prolonging the treaty of 2 May 1935 with a military agreement, it must be realised that the headquarters, especially that of the Air Force, showed little enthusiasm for this

idea, and preferred instead an alliance with Great Britain alone. This preference was all the more marked since General Vuillemin, who as commander of the bomber force before becoming 'Chef de l'armée de l'air' was already very influential, had right from the outset backed the necessary combining of the French and British Air Forces, especially the bomber forces, in order to create a counterweight to the air potential of the German-Italian bloc, which had been forming since the Italian intervention in Ethiopia.

The alliance with Great Britain was concluded in 1935 following negotiations between the two governments and senior military representatives from the two countries. Possible co-operation between the air forces was discussed initially, but discussions soon turned to the eventuality of having to repulse a German attack. The exchange of information on the potential available on both sides was followed in 1938 by the agreements on the stationing of a forward British battle force on the Continent, the co-ordination of the two air-defence systems, and the political, strategic and tactical conditions of employment of the offensive elements of the Air Forces. Throughout 1939 the talks were aimed at defining a common general strategy and at studying the ground, air and naval operations which would be possible in different theatres of war: Western Europe, the Mediterranean and the Middle East. In view of current potential and its foreseeable development, especially economic potential, the war policy, which right from the outset was based on the premiss that a long war would be an advantage for the Allies, aimed initially at simply maintaining the territorial integrity of the two empires and, subsequently, once sufficient resources had been provided, defeating Italy and then Germany.

Despite loyal and frank co-operation, each of the two headquarters gave priority to those objectives which were in the best interests of its own country. The British, haunted by the fear of an air attack against Great Britain, wanted to keep the bulk of their fighter force at home, with the exception of a few squadrons assigned to protect the Expeditionary Force. Since they were counting, in the long run, on the weakening of the enemy's industrial power, they wished to facilitate an attack by stationing offensive air forces in Champagne, which they regarded as the advance guard of Bomber Command. The threat posed to them by the invasion of Belgium and Holland led them to promise to employ their air forces against the German columns, should this actually happen. The French, for their part, feared above all a ground and air attack against their territory. The Air

Staff thus concentrated on attacking the German railway network so as to hinder the concentration of enemy forces – a course of action which understandably did not appear very appropriate to the English – and on supporting ground operations. They also wanted the number of English fighters defending French airspace to be increased. They insisted – justifiably from their point of view – on attacking enemy aviation on the airfields rather than in the aircraft factories. The only point on which there was agreement was that British bombers should be employed against German ground forces in the event of an invasion through Belgium and the Netherlands.

These are important points. They explain the co-ordination difficulties experienced during the Battle of France. The agreement on a general defensive policy also explains, first, the wait-and-see attitude which would be observed in the conduct of the air war and, second, the drawing-up of more or less realistic plans throughout the period under consideration. Some of these were at least implemented initially, and were designed to create secondary fronts which were to drain German strength, or to weaken the economy of the Reich by depriving it of essential resources by means of a more extensive blockade. Hence the operations aimed at drying up the sources of Soviet supplies (aid to Finland in March 1940 and the plans to bomb the Caucasian oilfields at Baku and Batum) or to 'cut the Swedish iron ore route' (Scandinavian expedition in April and May 1940); hence also the plans for intervention in the Balkans, the Middle East and East Africa. Although this policy was not global, it extended far beyond the European theatre, and was unrealistic in view of the resources available at the time and the strictly defensive character implied by its definition. However, neither the French Government nor the French High Command needed British assistance in determining the defensive character of their projects and plans. This assumption had led to the construction of the Maginot Line and to the neglect of the military resources that would have permitted more dynamic manoeuvres: armoured divisions and a bomber force worthy of the name.

A Hesitant Doctrine

A political conception of war results in a doctrine which logically operates the means necessary for the provision of the corresponding capacities.

During the 1920s and 1930s the operational doctrine of the air arm² underwent several transformations, the first of which had led to the creation of an autonomous Air Force. These transformations reflected the uncertainties arising out of a debate focused around two conflicting arguments, neither of which was fully correct. As was to become apparent in the distant future, the correct view was to be found in their synthesis.

The First World War had revealed the best uses for aircraft, including strategic bombing, by putting forward the idea of achieving air superiority as a preliminary to any military action. The years of peace that followed – possibly because insufficient consideration was given to the lessons learned from the colonial operations in the 1920s conducted in the absence of enemy air forces – caused the Army to forget this concept and to regard air forces merely as an auxiliary arm of the infantry, to be used exclusively for observation, reconnaissance and cover. The air-men, for their part, as a result of too vague an interpretation of General Douhet's alluring theories, preferred to see the young Air Force come into its own in an air battle against enemy air forces and in ground attacks, in operations independent of the land battle, against 'strategic' targets located far away from this battlefield.

Thus, before 1933 – when the Air Force officially came into being – the operational doctrine of the air forces was based entirely on support. This referred exclusively to the 'co-operation' of reconnaissance aircraft, which has to be escorted by fighter aircraft. The term 'co-operation' reflects the subordinate role of air forces at that time. By way of a reaction to this concept, General Denain, 'chef d'état major' under Air Minister Pierre Cot in 1933, and then Minister himself from 1934 to 1936, put forward the idea of the air battle, not just independent of the ground battle but probably preceding it, and for which, in line with Douhet's theories, all resources were to be available. However, he did not reject the idea of co-operation in the general battle, but he did point out that the corresponding support missions at the start of a conflict were not the only missions nor the most important ones.

The new doctrine was explained quite cleverly in August and September 1935 in the official *Revue du Ministère de l'Air*. The main concern was not to clash head-on with the ideas prevalent at the Army and Navy High Command. Thus, the authors recognised, as an inviolable principle, that 'for the Army and Navy, air forces are essential for co-operation, since they enable

them to conduct reconnaissance, protect themselves (escort units during combat, control artillery fire) and gather intelligence for the command'. However, they also introduced strategic air action, indirect support, the diversity of resources and their consolidated employment by asserting that modern air forces had to

intervene in support of army and naval operations on a much broader basis than that of co-operation . . . by intensive bombing of the enemy's rear areas, by harrying his lines of communication, by attacking and disrupting troop concentrations or outflanking manoeuvres . . . and combine all their forces with those of the Army, if the need arose. [It was] absolutely essential, because of the limited number of air forces that France [was able] to maintain, that all the air forces should be employed for the air battle, otherwise the special forces employed for this mission might be too weak at a critical moment. . . . To avoid always having the weak fighting the strong, our air forces [should], in their totality, be employed according to the circumstances, either in the air battle or in co-operation with and in direct support of ground and naval operations.³

The new doctrine also exposed the need to create a new balance between the various specialist fields, partly to the detriment of reconnaissance forces which, in 1934, still represented 60 per cent of the total strength, and to the advantage of the fighter units, which were to be 'vigilant, effective and strong', and in particular to the advantage of the bomber units, which were to be the spearhead of the new service and which, at this time, only made up a minute proportion (12 per cent) of the air forces. To achieve the desired changes without upsetting the Army, the emphasis was laid on versatility of resources and units and, without going as far as Douhet's all-purpose aircraft, a reconnaissance aircraft was invented, which could defend itself against fighters and double up as a bomber to support strategic operations. It was the multi-seater bomber-combat-reconnaissance (BCR) aircraft, which was supposed to be a multi-purpose aircraft, but which, in practice, had serious limitations and was vulnerable to ground and fighter fire, as was soon to be illustrated by its limited use in Spain.

Pierre Cot, who had returned to office with the Popular Front government in 1936, revised this doctrine in September 1937 in such a way as to condemn the offensive concept of the air battle alone, which was considered too rigid. This reform pursued

both political and operational goals. At this time, the myth of the danger of chemical air warfare and the fear of retaliation associated with the concept of strategic bombing were rampant; moreover, ideology imposed the idea of defence nobly opposed to any offensive adventure. At the time, the combat forces were referred to uniformly as 'defensive aviation', 'light' and 'heavy' referring to fighter and bomber forces respectively. It was also a matter of being conciliatory towards the War Ministry, so as to encourage the apportionment of budget funds. It was for this reason that the doctrine, which, at an operational level, took into account the ideas of General Jauneaud, Chef de Cabinet of the minister, undoubtedly exceeded the actual scope of these ideas in the form it took under Pierre Cot,⁴ which reflected the wishes of the Army. Indeed, these ideas were not always consistent with these wishes, and asserted, for instance, that 'within the scope of general strategy, there [were] as many strategies as there were individual battles, in the case of the Army, Navy and Air Force', and repeated their insistence on the notion of air superiority as a pre-condition for the success of a ground operation, maintained that this air superiority had to be achieved in combat – the main task of the air forces – and pointed out that 'the air forces [were] the advance guard of the armed forces' and that 'at present, the strategic role of general reserve [could] be assigned only to the air forces'.⁵

Nevertheless, the doctrine newly formulated at the end of 1937 rejected 'the fatal theory of air battle' as the use 'against uncertain targets of formations under the command of major Army units' and aimed at providing the Army, at all events, 'with those air-force formations which it would require . . .'.⁶ This doctrine was at the root of the demands (and interference) of the army command in the conduct of the air war, and heralded the structures subsequently set up for this conduct, thus sowing the seed of ineffective use, all the more so since the delays in these essential fields would clearly not favour the provision of coherent resources. Interestingly enough, the operational doctrine for the units of the Air Force functional commands of 1939 and 1940 went way beyond this doctrine, and the directive on the tactical employment of Air Force units, dated 31 March 1937, had not been modified either.

The Search for an Organisation

In the same way as it was searching for its doctrine, the Air Force was also struggling to find its organisation. The first law, dated 2 July 1934, laid down structures that were identical to the criteria governing the Army: that is, in peacetime the principle of dividing the territory into air-force districts obtained, with the district commander commanding the units and territorial command; in wartime, the mobilised air-force formations were divided into 'reserved forces' and 'forces placed at the disposal of the Army'.⁷ The latter were commanded by an air-force general 'placed under the command of the Général de l'Armée de Terre Commandant du Théâtre d'Opérations Terrestres (Commander-in-Chief of the Army Theatre of Operations)'.⁸

These structures permitted neither concerted action nor continuity, as they were thrown into confusion at the outbreak of hostilities. The most significant change initiated by Pierre Cot in 1936 consisted in rectifying these shortcomings. The reorganisation sanctioned by the decrees of September and October 1936

was intended to adapt the command closely to its wartime role. It was based, first, on the setting-up of major air-force units (which could be employed without delay and independent of the territorial command) . . . and, second, the setting-up of 'Commandements de l'Air régionaux' (regional air force commands) (already adapting in peacetime the command structure of the Air Force to that of the major Army units).⁹

This development was a decisive step towards operational effectiveness. Unfortunately, the structures it set up were, admittedly, quite costly. Another reorganisation, decided on in September 1938 by Guy La Chambre at the request of General Vuillemin, simply restored the provisions of 1934, with the same drawbacks as those described above, the most serious being the inability of the Air Force to conduct large-scale operations at the outbreak of hostilities.¹⁰

All things considered, the successive changes made in doctrine and organisation, which reflected the hesitation of political thinking (and also the strong conservative influence of the Army), had ultimately produced the scheme least suited to bringing the small air forces into operation in such a way as to benefit from the advantages they offered: rapid response, flexibility and economy of employment.

Uncoordinated Equipment Policy

The state of the French Air Force when war was declared is a striking example of the saying: 'It's no use running, you have to set off in good time.' It reflected not only the above-mentioned doctrinal uncertainties, as a result of which very few budgetary allocations were made for aircraft construction up to 1938,¹¹ but also the prolonged decline of the aeronautical industry between 1918 and 1934,¹² when practically no aircraft were built in France.

Every one of the founding ministers of the Air Force attempted to redress this situation. They all gave the impression of having hastily adopted measures which did not succeed in making up for lost time. General Denain hastened to acquire aircraft to ward off a threat he considered imminent, but without trying to re-establish an industry which was still totally unsuited; Pierre Cot went about rebuilding this industry, but could not provide the necessary investment; finally, Guy La Chambre, in 1938, benefiting from the achievements of his predecessors, obtained the required budgetary allocations, made the necessary investments, and was thus able to boost production in such a way that it compared favourably with British and German output. When, in the spring of 1940, this result was finally attained, it was already too late; but, above all, the inadequacies which had already hampered the efforts of his two predecessors also proved a stumbling-block for him: since the requirements of the command had not been stated early or clearly enough, the prototypes which could have gone into large-scale production rarely met the expected requirements. Moreover, they had been developed without consideration of their suitability for mass production. It was thus paradoxical that the decisions to produce certain types of *matériel* were based on the availability of production facilities rather than on operational requirements. Hence the Bloch 151 and 152 fighters.

In order to examine the chain of events which led to the situation of the French Air Force in 1939 and 1940, it is necessary to return briefly to successive plans for equipment.

'Plan I', decided on by General Denain when he believed that war would be probable by 1936 at the latest, was conceived in 1933 and promulgated in July 1934. It envisaged a 'numerically smaller but more modern and thus more powerful force'¹³ of 1,010 first-line aircraft and 200 reserve aircraft. In fact, it was a question of producing without delay aircraft whose prototypes

were from programmes that were several years old. Despite the acceleration demanded by the minister, by mid-1936 this plan had only produced 607 planes, which were already technically obsolete.

A five-year renewal plan, decided on at this time to improve the quality of the *matériel*, did not have much impact for two reasons: there were no recent prototypes, and the proposed cycle was insufficient to stimulate the modernisation of production methods. It could thus be said that the '1,010 Plan', at a time when aeronautical technology was making very rapid progress, had increased the disorganisation of the aeronautical industry. (Nevertheless, in line with the idea which had encouraged General Denain, on 7 March 1936 the French Air Force was quantitatively and qualitatively still superior to the incipient Luftwaffe.)

It is to Pierre Cot's credit that, as soon as he arrived at the Air Ministry in June 1936, he tackled the problem of modernising an industry which was dispersed into more than 30 firms and concentrated in the Paris region. He only managed a partial solution to this problem, since the rate of production for military aircraft at the end of 1937 was still no more than 35 planes per month (at which time it was already 120 in Great Britain and 350 in Germany), while investment in machine tools remained very low. However, the nationalisation of most airframe factories and one engine factory set in motion a total restructuring which provided the industry with more suitable means of production and which, at last, decentralised it to a great extent. However limited the measures taken by Pierre Cot may have been initially, they created the basis on which the French aeronautical industry was able to expand its capacities after it had received substantial budgetary allocations from 1938 onwards.

'Plan II', which was adopted on 27 October 1936, called for 1,500 first-line aircraft and 900 in reserve, and represented a doubling of the number of planes envisaged in Plan I. It was still a very modest target; however, the state of the industry, taking into account the funds it had now been allocated, did not allow the achievement of the production figures in the provisions of this plan for 1937. Thus, the minutes of the meeting of the 'Comité permanent de la Défense nationale' (Standing Defence Committee) on 25 February 1937 state: 'Pierre Cot, the Air Minister, pointed out that it was not possible at present, it is not reasonably possible to envisage a complementary plan to Plan II, since the latter was already hardly feasible . . . and appeared

to constitute the maximum possibilities of our aeronautical industry.' This situation undoubtedly explains the rejection, on 15 February 1937, by the 'Haut Comité militaire' of two new plans prepared by the 'Etat-Major de l'Armée de l'Air': a 'Plan III' for the development of air-defence artillery and a 'Plan IV' for manpower reinforcement.¹⁴

In January 1938, when Pierre Cot handed over office to Guy La Chambre, the French Air Force had 1,375 aircraft in service which could be called modern. All but 130 of them were born of Plan I of 1934, and met operational specifications which were 6 to 10 years old. These aircraft, not to mention the 1,700 which were even older, including the bombers, were obsolete compared with those being built at the time in Great Britain and Germany.

The new minister began by getting the 'Etat-Major de l'Armée de l'Air' (Air Force Staff) to define its requirements on the basis of the missions to be carried out by the Air Force, and, before any aircraft were ordered, making the industry capable of satisfying these requirements by means of large-scale investment. He also planned to correct the most obvious and most persistent deficiencies by purchases in the USA.

The requirements of the 'Etat-Major de l'Armée de l'Air', which had been reviewed without budgetary constraint, were determined at several meetings of the 'Conseil supérieur de l'Air' in March 1938. The resultant 'Plan V' was intended to ensure 'the air cover of French territory and satisfaction of the permanent air requirements of the Army and Navy, with the aim of achieving superiority of combined French and British offensive air forces over the corresponding total of German and Italian forces, on the understanding that France should attempt to match Germany . . .'¹⁵

The plan adopted on 15 March 1938 led to the activation of the following forces:

- Fighter units: 34 groups¹⁶ and 16 regional squadrons with 1,081 aircraft (41 per cent);
- Bomber units: 60 groups¹⁷ with 876 aircraft (33 per cent); and
- Reconnaissance units: 14 reconnaissance groups and 52 regional groups with a total of 636 aircraft (24 per cent).

Adding the 24 transport planes envisaged for the 'Infanterie de l'Air' (air infantry), the estimates of Plan V amounted to 2,617

first-line aircraft and 4,739 in total, including the reserves.

By June 1940, this plan, which was later accelerated and then increased to augment the reserves so as to compensate for losses, had, in fact, provided over 90 per cent of what had been forecast, i.e. 4,398¹⁸ aircraft were available, over 2,000 of which were commissioned in 1940. However, events led to priority being given to the supply of materials for which fully developed prototypes were available. This meant that more fighters and fewer bombers were built than had been envisaged.

As a result of these measures, the composition of the French Air Force at the end of 1939 was as follows:

- Fighter units: 23 *groupes* (out of 34) and 9 regional squadrons (out of 16);
- Bomber units: 33 *groupes* (out of 60); and
- Reconnaissance units: 14 reconnaissance *groupes* (out of 14), 47 observation *groupes* (out of 52).

There was a total of 3,516 planes on 1 December 1939, of which 1,919 were modern; 1,578, of which 817 were modern, were in units.¹⁹

On 10 May 1940, the day on which the German offensive was launched, the units had 2,200 planes, of which 1,100 were modern. These modern planes comprised 610 fighters, 130 bombers and 350 reconnaissance and observation aircraft.

The statement of requirements of Plan V specified six dive-bomber *groupes* and six strike-aircraft *groupes*. These formations had been retained because they appeared desirable in view of the observations made in Spain; they were not based on any tactical concept, and the procedures of employment only existed in outline. For the strike forces, which comprised four *groupes* activated successively from May 1940 onwards and a fifth in June, there were no precise operational directives, and experience was not acquired until they flew their first missions. The dive-bombers were withdrawn from the programme in February 1940 for want of an adequate study of requirements.

Increases in air-defence artillery assets were never considered by the Army, which controlled this arm; on 3 September 1939 anti-aircraft defence comprised 1,261 artillery pieces of all calibres and 1,800 machine-guns.²⁰

All things considered, the manpower problem was also a major obstacle to the increases in the capacity of the Air Force. The 'Manpower' plan which accompanied Plan V envisaged the

training, by April 1941, of 12,000 pilots, 3,200 observers and 15,000 mechanics. It was not possible to establish the schools required to implement this programme before the end of 1940. In June 1940, of the 5,500 students receiving training at that time, only around 250 fighter pilots were able to join formations – which had, by that time, already lost a far greater number of pilots.

War is the most brutal and most perfect expression of the force ratios on which the hierarchy of nations is established. As far as air forces were concerned, at the outbreak of hostilities in 1939, the French forces, even combined with those of the British, were, in reality and in the minds of the High Command, far inferior to those of the enemy, both in terms of numbers and, above all, in the dynamics of their employment. This situation is explained by the above-mentioned facts relating to French air policy and doctrine.

Given these facts, it is important to understand the strategy of the 'Commandant en Chef des Forces Aériennes', General Vuillemin, for the conduct of the air war, for which he was responsible from beginning to end, having first been 'Chef d'Etat-Major Général de l'Armée de l'Air' (Chief of the Air Force General Staff) from February 1938 until the declaration of war.

The Conduct of the Air War

The conduct of the air war is to be seen as part of the general conduct of war at governmental and inter-Allied level. French policy was strictly defensive: 'resolutely pacific, she [France] will never start a war and must, therefore, suffer one'.²¹ By a disturbing contradiction, she had concluded pacts of mutual assistance with partners whom she could not possibly support. Even with the support of Great Britain, France did not have the means either to rush headlong into an adventure in the Balkans or to bypass or breach the fortifications erected on the Rhine by Germany and herself. Moreover, she did not have the offensive air power which could have enabled her to operate from the air in a suitable manner.

A Strictly Defensive Strategy

Moreover, the 'Chef d'Etat-major de la Défense nationale' (Chief of the General Staff), General Gamelin, put it quite bluntly

during a meeting of the Supreme War Council on 7 September 1939: 'We cannot provide Poland with rapid and direct support . . . The Air Force cannot intervene directly for the benefit of Poland . . . Air action should be directed against German air bases and lines of communication on the Eastern front: this action would result in retaliation on the Western front, and what we need above all is to build up our forces in calm conditions . . .'.²² Such a declaration does not require any comments. It affords a glimpse of French military thinking at the time of her entry into the war, a way of thinking which was, moreover, largely shared by Great Britain: first stand firm, then hold out until it is possible to go over to the offensive. This was also pointed out by Camelin at the same time: 'We must not hastily launch large-scale ground operations, but must wait until we have achieved maximum augmentation of our resources . . . we must husband our resources with a view to a long war. . . . The war will be won on the Western front.'²³

As far as the air war was concerned, the High Command, like public opinion, was dominated by a somewhat mythical perception of the 'aerochemical' danger and the permanent fear of retaliation in the event of imprudent initiatives on its part. These sentiments undoubtedly had their roots both in a gross over-estimation of the actual power of the Luftwaffe and in a profound failure to appreciate the actual possibilities, in 1939, of air forces in general. Paradoxically, General Vuillemin was also no stranger to this over-estimation and misjudgement.

This general officer had been appointed head of the Air Force by the Air Minister, Guy La Chambre, at the beginning of 1938. At that time, it appeared that the morale of the Air Force needed improving, and General Vuillemin, as a result of his operational experience, enjoyed great prestige as a soldier and aviator. During the First World War, he had been a bomber specialist and ace, with ten air victories and 17 decorations to his name. He had also distinguished himself in several air raids, including the famous 'Croisière Noire'. An experienced professional, he had risen from the ranks, and was not a graduate of the 'Ecole de Guerre' (War College). He was neither an intellectual nor a dogmatist, and, although he was endowed with a marked sense of the practical, he lacked the capacity to perceive how aeronautical technology would evolve and how this would lead to a radical change in air-force tactics. Upon entering the war, he realised that the war he was going to have to fight was not the war for which he had prepared.

Nevertheless, his estimation of the situation of his forces was quite realistic. As the Commander of the 1st Air Corps, in January 1938, acting outside official channels, he had painted a rather gloomy picture of the bomber forces to the minister. These forces were just about capable – and even then only partially – of engaging lightly defended, ‘easily locatable’ targets at night, whereas ‘no missions were possible during the day and in fine weather without risking considerable losses’.²⁴ After he had become Chief of the Air Force Staff, he stated, a few months later, in the course of the discussions preceding the Munich agreements, that his air forces would be swept away in two weeks. In the summer of 1939, when the decision was taken to enter the war, his opinion had not changed, and, even though he and his minister admitted that, following some modernisation of the fighter forces, the situation of the air forces would be less of a burden on the decision than it had been a year earlier, he was still of the opinion that the capabilities of the bomber forces had in no way taken a turn for the better.

This judgement was undoubtedly not over-pessimistic, and the Air Minister conceded at the end of 1939: ‘On the occasion of the international crisis that occurred in the spring, and of that which preceded our entry into the war against Germany, General Vuillemin accurately estimated the capabilities of the French Air Force and issued directives on the employment of these forces corresponding to the various possible hypotheses.’²⁵

A Cautious Strategy of Economy of Resources

Such operational directives shed light on the strategy of the commander-in-chief, which was initially based on strict economy of resources, especially for the least modern and thus most vulnerable categories, that is, the bomber units and reconnaissance and observation formations. Within the scope of the agreements concluded, the basic hypothesis was the combination of French and British bomber forces for the execution of missions traditionally described in operational regulations, notably in the French regulation formulated in the summer of 1939 and published in 1940.²⁶ These missions were: the fight against the sources of the enemy’s war potential (attacks on industrial and economic targets on enemy territory), the fight against the enemy’s air force (attacks on occupied airfields), participation in ground operations (attacks on targets ‘of importance to ground

operations but located beyond the range of ground weapons . . . normally in the rear area of the battlefield') and retaliatory operations.

The French regulation, which at the time of its formulation expressed the sentiments of the 'Chef de l'Armée de l'Air', also made provision, 'in exceptional cases or with the support of specialised formations, for direct intervention in ground operations to support the action of the other arms'. As far as this last task was concerned, all the paragraphs dealing with the procedures or conditions of its execution by the so-called specialised air forces (strike aircraft and dive-bombers) restricted themselves to recommending low-level flying for strikes. For dive-bombing, they consisted of one line stating: 'to be published at a later date'.²⁷ In fact, as we have seen, dive-bombers never existed in the French Air Force (naval aviation only had a few such aircraft), while the first strike formation was activated in April-May 1940. In the minds of the Air Force commanders, the normal mission for the bomber forces was strategic bombing, in which 'the fight against enemy air forces (air forces of the services and independent air forces) [was] a permanent mission . . . to be pursued systematically for the entire duration of the war with all available forces'.²⁸ If a decision was taken in favour of direct intervention in ground operations with so-called heavy air forces, it was done reluctantly and in exceptional cases: 'In times of crisis, commanders may be forced to have recourse to bomber forces not specialised for the latter mission; but such operations conducted with *matériel* not suited to this type of attack may produce results that are out of all proportion to the resources employed and heavy losses which could not be made good for a long time . . .'.²⁹

With little enthusiasm, but lucidly, the regulation envisaged disaster and, so to speak, courted it. Taking all these facts into account, General Vuillemin had once and for all decided that, until *groupes* equipped with modern *matériel* (LeO 45, Glenn-Martin, Douglas, Amiot) had entered field service, the French bomber forces would only operate at night and, as a rule, only in conditions which would not expose them to enemy fire for too long, that is, in zones limited to the Rhineland and Black Forest. Except, of course, in the event of a 'serious crisis', when they would be employed without regard to the possible risks, including by day on the battlefield and, if necessary, in retaliatory action envisaged against Berlin and Munich.³⁰ The logical consequence was that the British would normally have had to fly all

the daytime missions, although the command of the Royal Air Force had pointed out from the outset that its planes operating in France (Fairey Battle and Blenheim) were not much less vulnerable. . . . They also had to fly all missions north of the 51st parallel from England, by both day and night.

As for the observation units, which were initially the eyes of the major Army units as well as the intelligence agents of the High Command, precautionary measures had to be formulated at a very early stage for their employment. What was called the 'phoney war' was a real war, even if it was fought at a low level of intensity by the Air Force. By 30 November 1939, after three months of almost total calm on the ground, the reconnaissance forces in the Eastern zone had flown over 700 long-range reconnaissance missions and over 300 observation missions over enemy territory close to the front; they had lost 25 aircraft, and 16 others had returned with crew members killed or wounded. By this time, the command had already had to take the decision to remove from the battlefield the very old types of observation aircraft (Potez 25 and 39, Breguet 27) with which half the units were still equipped. It realised that the old *matériel* with which the remaining observation groups were equipped (Mureaux 117 and Potez 540) would have to confine its activities to the immediate vicinity of friendly lines in order to survive. Similarly, as far as the observation balloons, which were employed by 49 Air Force observation companies, were concerned, the lessons learned during the first few weeks of the war demonstrated that it was necessary to discontinue their use immediately. The same was true of the autogiros, which had never, moreover, flown an operational mission, so obvious was their vulnerability, even without practical experience. But this experience already showed how difficult it was to establish, even temporarily and only locally, adequate air superiority.

For this reason, in the winter of 1939, the command decided to allow observation aircraft only very low depths of penetration (15 to 20 km) beyond friendly lines, corresponding to a length of stay over enemy territory of around 20 minutes. At the same time, it decided to resort to the direct protection of these missions by fighter formations which could amount to three or four patrols of three aircraft each for one single observation aircraft. Similar precautions were taken for 'long-range' reconnaissance, with distances and durations varying according to the type of plane and its degree of modernisation, as well as enemy reactions. The commander of the 1st Air Force is authorised to

withdraw, to the extent he considers necessary, the forward edge of the reconnaissance area of the reconnaissance groups of the ground forces . . . [and] will be guided by the above directives for the organisation of aerial reconnaissance.³¹ However, the directives issued in this way still indicated that, if necessary, every risk would be taken.³²

Nevertheless, General Vuillemin's strategy of employment for the Air Force, in line with the general strategy, consisted of holding out and 'concentrating forces'. This strategy of economy was further illustrated by the directives which enjoined the subordinate commanders not to take initiatives under any circumstances which could trigger 'the air war'. In fact, the orders were not to employ the bomber forces before the enemy had started employing his. Such directives can be observed not only in the instructions given right at the start of the war ('these terrain sectors will not be attacked until the enemy has initiated offensive air operations', Special Directive No. 2 dated 6 September), but also on the eve of the German offensive ('in execution of the decisions of the French Government and in accordance with the directives of the Commander-in-Chief and 'Chef d'Etat-Major Général de la Défense Nationale' [Chief of the General Staff], the Air Force will only commence bombing operations if the Germans initiate aerial bombing', Special Directive No. 22 dated 12 April 1940) and even after battle had been joined, as far as attacks against not strictly military targets were concerned ('these counter-attacks and all attacks against industrial targets will not be launched until the Commander-in-Chief of the Air Force issues a new special directive', Special Directive No. 27 dated 31 May 1940).

These precautions explain why, until the offensive of 10 May 1940, the bomber forces had only flown reconnaissance and propaganda missions, dropping millions of leaflets, and why they had only flown them by night.

In a parallel development, following the conclusion of the French pseudo-offensive mounted in the Saar for a few days at the beginning of September 1939, further precautions were judiciously ordered by the Air Force Headquarters - despite objections by the Army Command - with the aim of re-echeloning in depth all air forces so as to better protect them against the effects of a general surprise attack by the Luftwaffe.³³ The deployment following the start of operations had also been prepared.³⁴

A 'Hand-to-Mouth' Conduct of Operations Following Rigid Patterns

Within this narrow framework, however, orders were issued for the conduct of air operations, orders of both a general nature and – with the gradual realisation of the increasing probability of the threat – on the basis of a number of fairly accurate hypotheses corresponding to the different modes of action of the enemy. A study of the general orders of the 'Commandant en Chef des Forces Aériennes',³⁵ his special instructions and the war diaries of the Air Force Headquarters and of the zones of air operations³⁶ gives the impression of a conduct of operations organised a priori, somewhat theoretical and abstract and leading to rather rigid patterns – and attempts were made to adhere to these patterns, however little they had to do with reality as a result of the scarcity of resources.

The general concept of operations, identifiable since 6 September 1939,³⁷ assigned the following missions to the air force in the main theatre (the only active one, moreover): (1) with priority to support the ground operations 'at the request of the Commander-in-Chief of the Army, if the situation justifies this'; (2) to reconnoitre the deployment of the enemy air forces; (3) to attack enemy airfields identified as being occupied (with the above-mentioned restrictions not to take the initiative). This general concept of operations was modified and augmented, as the weeks passed, to adapt it to the projects of the Army command: the details of operation 'Dyle', effectively conducted in Belgium, had emerged at a very early stage. Within the overall strategy, there were air forces permanently at the disposal of the ground forces (observation *groupes* at army, corps and division level; reconnaissance and fighter *groupes* at army level) and air forces reserved for the level of the 'Commandant en Chef des Forces Aériennes' (the fighter *groupes* intended for territorial air defence and possible reinforcement of the fighters at army level, the strategic reconnaissance *groupes* and all bomber formations). Operation 'Dyle', which was prepared, anticipated and conducted – although the German initiative deviated greatly from the basic presupposition – involved the following Air Force operations:

- the initial employment of 6 bomber *groupes* (78 old Amiot 143 and Farman 222) *exclusively at night*, against enemy columns, lines of communication and – but *only following German air*

- attacks – the bombing of airfields identified as being occupied;
- the subsequent employment, by day and night, of another 12 bomber *groupes* as soon as they had been equipped and supplied with modern *matériel*, which meant that the first were not available for use before the end of April and the last not until the end of May;
- the employment, by day, of all available bombers, including the oldest, with the exception of the 26 four-engined ones (Farman 222), 'in the event of a penetration of our defensive position', for direct support of ground operations; and
- the employment of all available fighters:
 - to protect day bombing missions and reconnaissance missions;
 - to protect the deployment of friendly air forces;
 - to protect the army formations and their movement, especially by rail;
 - to protect sensitive points on French territory (especially Paris and the Lower Seine).

The scenario thus described was played out as it stood, with the implacable decision that fate sometimes imposes. In compliance with the order issued on 8 October for this eventuality, 'on the night following the launching of the German air attack, the 1st Air Force will attack those airfields identified as being occupied, with priority on bomber bases',³⁸ five aircraft took off to bomb four airfields in the night of 10/11 May. Then, after all air forces had been placed at the disposal of the new Commander of the North-eastern Front for operations that were under way, when, by 14 May, the situation on the ground was already hopeless, the decision was taken to intervene 'massively and without respite' in broad daylight on the Meuse with all available bombers – only 30 aircraft reached Sedan. It was not until after 2 June, when General Vuillemin once again had the entire reserve³⁹ under his command and now had 18 bomber *groupes* equipped with suitable *matériel*⁴⁰ at his disposal, that a more significant concentration of forces was apparent, 180 bombers and 15 fighters, protected by 250 fighters, to attack 3 Panzer divisions at Chaulnes on 6 June, for example.⁴¹ And it was not until 7 June, after one month of intensive fighting, that a new special directive⁴² defined the 'conditions of employment of bomber forces in support of ground operations'. This directive, based on the experience acquired between 10 and 31 May, rectified the mistakes that had been discovered. These mistakes, like the judicious remedies proposed, showed how inadequate

previous deliberations had been: principles which should have served as a basis for operational regulations, the organisation of units, the definition of their *matériel*, the co-operation between the various branches and the training of personnel, were only understood in the light of experience. This delay and deficiency shows just how poorly the command was prepared mentally.

Thus, finding itself confronted with an unexpected form of war, the command was in a situation in which it had to employ its air forces, both fighters and bombers, almost entirely for tasks described as possible or even exceptional in the regulations. Sparing with its offensive and observation forces, out of prudence and for reasons of strategy, the command was wasteful with its fighters, in particular to protect the observation forces and screen the ground forces. Impressed by the tactical air forces of the enemy, it did not cease to demand, from 15 May onwards, the support above the battlefield of all the resources of Fighter Command, too many of which, in its opinion, had scandalously remained inactive in Great Britain. It did not realise that the effectiveness of its air forces was inhibited just as much by its size as it was by the conditions of employment, i.e. the organisational structure of the command.

Complicated and Vague Organisation

Shortly before the war, General Jauneaud had stated, with premonitory bitterness: 'Should there be a military disaster liable to drive France to the verge of ruin, it will undoubtedly be due to organisation.'⁴³

The organisation of the command of the French armed forces for the conduct of the war, both at the highest joint-service level and at the operational level of the Air Forces, was ambiguous, inadequate and unstable. At the head of the High Command there were: a 'Commandant en chef, Chef d'Etat-Major Général de la Défense nationale' (Commander-in-Chief, Chief of the General Staff), who was at the same time 'Commandant en Chef des Forces Terrestres' (Commander-in-Chief of the Ground Forces) and who, in May, was given the title of 'Commandant en chef de l'ensemble des théâtres d'opérations' (Commander-in-Chief of all Theatres of Operations) (General Gamelin, then General Weygand); a 'Commandant en Chef des Forces Maritimes' (Commander-in-Chief of the Naval Forces); a 'Commandant en Chef des Forces Aériennes' (Commander-in-Chief of the

Air Force) (General Vuillemin); and a 'Commandant du Théâtre d'Opérations du Nord-Est' (Commander of the North-eastern Theatre of Operations), who, in January 1940, was given the title of 'Commandant en Chef des Forces Terrestres sur le Front du Nord-Est' (Commander-in-Chief of the Ground Forces on the North-eastern Front) (General Georges).

Relations between Gamelin, Vuillemin and Georges remained ambiguous. In fact, the powers vested in General Gamelin by the 'Secret Decree of 7 September 1938 concerning the Direction of the War and the Conduct of Operations' included the 'authority of the War Committee to co-ordinate army forces and air forces, with the exception of independent missions assigned to the latter'.⁴⁴ His authority over the Commander-in-Chief of the Air Force was the less clearly established inasmuch as his own title of 'Commandant en Chef des Forces Terrestres' (Commander-in-Chief of the Army) placed him on an equal footing with the former. Moreover, when France entered the war, he addressed his order of the day to the ground forces alone, and transmitted it to Vuillemin with a friendly note, concluding with the words: 'I am sure that, as in the Great War, the Air Force will fight side by side with the Army.' Vuillemin's powers gave him control over the 'reserved' air forces only, and conferred upon him what would today be called the 'technical and tactical direction' of the Air Force units permanently assigned to the Army; those of Georges comprised the tactical command of these units. These respective prerogatives did not, in principle, establish any link between these two authorities, except – as we shall see later – by the intermediary of the commands which were subordinated to one or the other depending on circumstances. Nevertheless, there was no lack of opportunities for Georges to contest Vuillemin's decisions on the employment of the forces attached to him or on the reorganisation which, in the opinion of the Commander-in-Chief of the Air Force, was necessitated by the battle, and to call upon Gamelin and later Weygand to arbitrate. Nor was there a lack of opportunities for Vuillemin to consider the claims or demands expressed by Georges as pure interference when they appeared, to relate to technical or 'professional' aspects of the employment of aircraft. In fact, the headquarters kept themselves informed of their activities, in particular by participating, at chiefs-of-staff level, in each other's 'major briefings'.

The organisation for the employment of the air forces was complex, assumed several shapes, and only gradually developed between September 1939 and February 1940. There was

fortunately enough time available to establish the structures before the German attack.⁴⁵

The command agencies of the Air Force were to enable – if possible while ensuring a certain unity of action and rapidity of intervention – a conduct of air operations:

1. independently of the ground battle;
2. in combination with this battle; and
3. in direct support of ground operations.⁴⁶

Corresponding to each theatre of operations there was one Air Force comprising:

1. reserved forces; and
2. tactical Air Force units (reconnaissance, observation and fighter).

The theatre of operations was subdivided into army groups, and each army group co-operated with a zone of air operations whose subordination was not very simple.

In fact, the Air Force General commanding a Zone of Air Operations received orders from:

1. the 'Commandant en Chef des Forces Aériennes' (Commander-in-Chief of the Air Force), via the Commander of the Air Force, for the employment of the reserved air forces, except when these forces were employed in direct support of ground operations;
2. the Commander of the Army Group for the employment of units assigned to major Army units and for the operations of the reserved air forces when conducted in direct support of ground operations; and
3. the Commander of the Air Force for general (technical) conditions of employment of forces earmarked for co-operation with and thus (permanently) assigned to the major Army units; and for general conditions of employment of reserved air forces when employed in direct support of ground operations.

Finally, at army, corps and division level (in the ground forces), there was an 'Air Force Command' with staff, changed with the employment of the air forces placed at the disposal of the respective commanders of these army units.

The employment of the air forces reserved for offensive tasks was organised by the 'Air Divisions', which were under the direct control of the 'Commandant de la Zone d'Opérations Aériennes'; these were flexible agencies for the employment of units not assigned on a permanent basis, which could comprise all offensive, defensive and reconnaissance forces required for the preparation and execution of specific missions.

Such structures overlapped in many areas, thus prohibiting clear delineation of authority and confusing even the commanders-in-chief themselves. In October 1939 General Vuillemin wrote to General Gamelin to explain the employment of the reserved air forces and to justify the creation of zones of air operations:

This reinforcement, realised in the form of a mission credit for the benefit of a ground army and not by assigning *matériel* and manpower is the most rapid and only logical solution. . . . For the employment of air forces in conjunction with ground operations, the zone of air operations will solve the problem of liaison between the Army command and the Air Force command. The Commander of the Zone of Air Operations is subordinate to both the Commander of the Army Group and the Commander of the Air Force, a double subordination analogous to that of the Commander of the Air Force, who is subordinate to the 'Commandant du Théâtre d'Opérations Terrestres' and the 'Commandant en Chef des Forces Aériennes': the Commander of the Army Group is thus in an optimum position to obtain, should he need it, the maximum support from all forces assigned to the Commander of the Zone of Air Operations, that is, both forces at the disposal of the major Army units and reserved forces . . .⁴⁷

The Commander of the North-eastern Theatre of Operations became 'Commander-in-Chief of the Ground Forces on the North-eastern Front' in January 1940, and the Air Forces were dissolved in February. The 1st Air Force was replaced by the 'Commandement des Forces Aériennes et des Forces Terrestres anti-aériennes mises à la disposition du Général Commandant en Chef des Forces Terrestres sur le Front du Nord-Est' (Command of the Air Forces and Air Defence Ground Forces placed at the disposal of the Commander-in-Chief of the Ground Forces on the North-eastern Front), which also had the shorter title of 'Commandement des forces aériennes de coopération et des forces terrestres anti-aériennes sur le front du nord-est' (Command of the Air Forces earmarked for Cooperation and Air-Defence Ground Forces on the North-eastern Front).

Parallel to this reorganisation – which, for the air forces, abolished the Air Force echelon – further restructuring took place by means of simplification. For the operational employment of the reserved combat units, all that was retained between the commander-in-chief and the *groupes* was the zone of air operations, the division and the 'groupement', this latter unit replacing the wing and the brigade, both of which were also abolished in February 1940.

Even after such simplification, the organisation was still designed for much larger air forces, whereas here it was a question of managing shortages. The concept of organic observation units led to the fragmentation into innumerable small air-force units too weak to sustain a lasting effort, and often demanding a similar fragmentation of the fighter forces for their protection. The assigning – also organic at army level – of non-reserved fighter groups also immobilised too many resources even without this constraint, if one considers hypothetical requirements to permit concentrated employment, which would have permitted more flexibility and better economy of resources.

The new Air Force had an offensive doctrine, embodied in its regulations. The resources, still in the build-up phase, which it possessed at the time of its employment were predominantly defensive. The air defence units were also the only ones which were of real operational value at this time; but they were hopelessly inadequate, not so much because of their quality as because of their conditions of employment, to which radar, for instance, was totally foreign, and which were burdened by extremely inadequate communications.

This general force-structure, combining resources that were too weak and an organisation that was inappropriate, contravened its own definition: an organisation that consisted of placing air-force units at the direct disposal – temporarily or permanently – of specific army units was an offensive organisation, which only made sense in offensive operations where it is possible to determine the type, place and time of action. The combination of air-force units with army units would only have been conceivable in a situation in which resources for specific missions were available in the units. In the defensive situation which corresponded to military policy and general strategy, it was necessary to be constantly vigilant and, consequently, to keep open the centralised possibility of rushing forces to where they were needed. The reorganisation decided upon in the spring of 1940, however, headed towards more flexible employ-

ment and created the possibility of concentrating forces to permit a certain operation. One of the aspects of this flexibility was the opening towards what was – although much later – genuine co-operation: the joint planning of missions 'by direct co-ordination between the Army and Air Force commands . . . initiated upon the orders of a specific level of the Army command, addressed directly to the Air Force combat units concerned'.⁴⁸

Insufficient resources, a lack of organised communication procedures, an ill-prepared army and events that took place too rapidly – all these prevented the creation of what could have been the French 'tank-aircraft combination'.

Notes

1. Général Jean André Léon Hébrard, *Vingt-cinq années d'aviation militaire 1920-1945*, Paris, 1946-7, Vol 1, SHAA 1498/1.
2. On the doctrine of the Air Force, see the masterly paper presented by Arnaud Teyssier at the 'Air 87' colloquium in Paris (*Actes du colloque Air 87*, Service Historique de l'armée de l'Air, Paris, May 1988).
3. *Revue du Ministère de l'Air*, 15 September 1935, anonymous article reproducing, it would appear, the contents of a speech by General Denain (Cote SHAA 8/ P/108).
4. Directive 614/CM 2 of the Air Ministry, 25 September 1937 (SHAA 2 B1).
5. Général Henri Jauneaud, *Les principes actuels de la guerre française*, manuscript prepared in 1939 but not published (SHAA Z 21320-3).
6. Directive 614, 25 September 1937 (note 4 above).
7. Law on the Organisation of the Air Force, 2 July 1934.
8. Ibid.
9. Directive of the Minister, 4 November 1936, SHAA 2 B1.
10. Decree, 2 September 1938.
11. Air Force share of procurement expenditure (in relation to the defence budget): 1934 to 1936 – 27 per cent; 1937 – 32 per cent; 1938 – 42 per cent; 1939 – 51 per cent. Statement by Jacomet to the Serres Committee, SHAA G.184/3.
12. The number of employees in the aeronautical industry had dropped from 183,000 to less than 4,000 in 1921; in 1934, there were only 21,500 (Charles Christienne and Pierre Lissarrague, *Histoire de l'Aviation Militaire Française*, Paris-Limoges, 1980).
13. 'Historique des plans d'accroissement et de rénovation de l'armée de l'Air', Directive B 130, 3 March 1938, SHAA 2 B1.
14. Decision of the Supreme Military Council of 15 February 1937. The minutes stated: 'There is no reason for modifying or extending, at present, the plan

- to enlarge the Air Force.' Quoted by Pierre Cot in his hearing by the Serres Committee on 1 August 1947, SHAA G/184/3.
15. Directive No. 68/Dn 3, 8 February 1938, SHAA 1 B3. The underlined part of the sentence was also underlined in the original text.
 16. 26 aircraft per fighter *groupe* and 12 per regional squadron.
 17. 2 heavy *groupes*, 23 *groupes* of 'rapid resources', 23 light *groupes*, 6 strike *groupes*, 6 dive-bomber *groupes*. There were 13 aircraft per bomber *groupe*.
 18. Including 544 planes purchased from and delivered by the USA.
 19. 'Situation de l'armée de l'Air', statement produced by the D.M.A.M. (Direction des matériels aériens militaires), 26 December 1939, SHAA 3 B55.
 20. Serres Committee, statement by Jacomet on 18 July 1947, SHAA B/P/108.
 21. *Revue du Ministère de l'Air*, September 1935, SHAA 8/P/108.
 22. Quoted by Elisabeth du Réau, 'Edonard Daladier et le problème de la sécurité de la France: 1933-1940', unpublished thesis, Doctoral ès Lettres, Paris 1, Histoire, Sorbonne, Paris, 1987.
 23. Ibid.
 24. Letter to Guy La Chambre, 15 January 1938 (published in: *Les événements survenus en France entre 1933 et 1945*, Imprimerie nationale, SHAA G/184/3).
 25. Personal papers of General Vuillemin.
 26. Regulation for the Employment of the Bomber Force, Paris, Imprimerie nationale, 1940.
 27. Ibid.
 28. Ibid.
 29. Ibid.
 30. Special Directives No. 14, 16 October 1939 and No. 21, 12 April 1940, SHAA 1 D1.
 31. Special Directive No. 3, 8 September 1939, SHAA 1 D1.
 32. Special Directive No. 9, 19 September 1939 and Special Directive No. 21, 12 April 1940, SHAA 1 D1.
 33. Special Directive No. 5, 14 September 1939, SHAA 1 D1.
 34. Special Directive No. 8, 18 September 1939 and Special Directive No. 13, 8 October 1939, SHAA 1 D1.
 35. SHAA 1 D1.
 36. SHAA D1-162 and D1-408.
 37. Special Directive No. 2, SHAA 1 D1.
 38. Special Directive No. 13, 8 October 1939, SHAA 1 D1.
 39. Special Directive No. 27, 31 May 1940, SHAA 1 D1.
 40. Leo 45 (6 *groupes*), Breguet 691 (1 *groupe*), Breguet 693 (4 *groupes*), Douglas DB7 (3 *groupes*), Glenn Martin 167 (4 *groupes*) (Historiques des groupes de bombardement, SHAA).
 41. SHAA 3 D 498-1 and 3 D 477-1.
 42. Special Directive No. 32, 7 April 1940, SHAA 1 D1.
 43. SHAA, Z 21 320.
 44. SHAA, 2 B 109.
 45. The creation of the various Air Force command agencies appears in the successive general orders of General Vuillemin, under the letterhead of the General Staff, SHAA 1 D1.
 46. SHAA 2 B 109 and Directive No. 706/DN3, 9 September 1939, of General Gamelin 'regarding the respective powers of the army and air force com-

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mands in a theatre of operations', SHAA 8 133.

47. SHAA 2 B5.

48. Directive, 17 February 1940, SHAA 1 D 37.

The archives with the following file numbers were also consulted:

1 D8 - 2 B 110-111-112, 1 D 46 - 2 B 106, 3 0 519, 3 D 495, 1 D2, 1 D 33/34/35/36.

General H. H. Arnold and Strategic Bombardment

John W. Huston

The implementation of the concept of strategic bombing by the Army Air Forces during the Second World War was not only the result of decisions made at the highest political level in the United States and Great Britain, but was the main concern of General Henry H. 'Hap' Arnold, the commander of the Army Air Forces. This brief assessment will attempt to show the development of Arnold's thinking concerning the effectiveness of strategic bombing up to the formal acceptance of his hypothesis on the subject in January 1943 at Casablanca. The paper will also document his efforts to ensure that the doctrine, strategy and primary resources of Army aviation in the Second World War were concentrated on this untested concept.

Tracing the evolution of an idea in any human being's mind appears as difficult a task in studying Arnold as in any other mortal. His only biographer offers little insight, and makes the serious student wary of his study, which labels Douhet a Frenchman.¹ The fact that the institution which he led during the war appears to have embraced doctrinally the concept of strategic bombardment leads to the difficult task of attempting to separate institutional beliefs from individual ones, particularly in discerning whether the leadership created or shaped institutional goals, or was in turn shaped by them.

Arnold, the leader of the AAF from the beginning of the build-up of American air power in the late 1930s through to the end of the Second World War, was born and raised just west of Philadelphia. Torn between serving God as a Protestant clergyman and joining the military (an interesting juxtaposition of careers), young Arnold entered West Point, beginning his studies less than five months prior to the Wright brothers' historic flight on the sands at Kitty Hawk.

Graduating without distinction in the class of 1907 at West Point, he was assigned as an infantry officer to the Philippines. *En route* back to the United States in 1909 he was not over-impressed with Bleriot's aeroplane, which had just flown the English channel and was now displayed over the Place de l'Opéra in Paris. Arnold wrote: 'I was not very greatly impressed by its appearance for it seemed to be too fragile looking to have any real value as a means of transportation.'²

Attracted by the promise of promotion if he learned to fly, and having just failed an examination to enter the Ordnance Corps which offered the same reward, Arnold moved to Dayton, where he was taught this new but dangerous art by the Wright brothers. After three hours and forty-eight minutes in the air he was awarded his 'wings' and issued Aviation License number 29. Flying in a variety of aircraft from locations around Washington, DC, Arnold established a world altitude record of 6,540 feet in 1912, and was the first military aviator to use radio to report his observations. A series of crashes in 1913, both his own and those of close friends, persuaded him to abandon that dangerous activity, for what we aviators term 'fear of flying'.³

Reassignment to the ground forces in the Philippines followed; but he returned to flying duty in 1916, lured once more by the promise of promotion. The United States entrance in the First World War found Captain Arnold commanding an air squadron in Panama; but he was quickly reassigned to Washington, where he rose rapidly from Captain to Colonel in six weeks, becoming among the youngest of that rank in the Army. He spent the remainder of the war engaged in aircraft procurement, and although frustrated in his desire to reach combat on the western front, showed strong interest in the adaptation of technology to military aviation. He reached France two days before the signing of the armistice, after a brief hospitalisation in England – a stay which either developed or enhanced strong Anglophobic feelings.⁴

Routine peacetime assignments followed, and in 1924 Arnold was back in Washington as Director of Information for the Army Air Corps and a publicist for Billy Mitchell during his court-martial ordeal. Following schooling and other home assignments, he was promoted to Brigadier General in 1936, and became Assistant Chief of the Army Air Corps. As a result of the death of the Chief in an aircraft accident in September 1938, Arnold was promoted to Major General, and appointed head of the Army's air arm the day before the signing of the Munich

agreement bringing 'peace in our time'. He headed the Army Air Forces for the next eight and a half years, progressed from two- to five-star rank, and became the recognised American spokesman for land-based aviation.

Arnold's intellectual debt to Billy Mitchell, given the belief of the latter in strategic bombardment, is not clearly documented. Arnold's relations with Mitchell dated from as early as 1912, when he sought Arnold's opinion on air power for use in an Army War College paper.⁵ Both testified before Congress in 1914. Arnold met and talked with Mitchell during his brief visit to France in 1918, and when Mitchell returned to Washington for his court-martial trial in 1925 it was Arnold and his wife who met the Mitchells at Union Station, and Arnold who served as Mitchell's 'liaison man' (the term is Arnold's), and arranged an apartment for them. Arnold along with other officers collected documents to support Mitchell's testimony, offered their views of court-room strategy, and provided encouragement for their hero.⁶ Trenchard's comment that 'Mitchell tried to convert his opponents by killing them first' seems appropriate to describe his behaviour in the 1920s, and Arnold and others who did not possess Mitchell's brashness, rank, bravado and private income seemed willing in 1925 to provide him the weapons with which to slay his opponents.⁷ Arnold testified at the trial, and hinted at the future of long-range use of aircraft when he pointed out that in aerial war 'distance is annihilated by a few hours'.⁸

Arnold's strongest action in support of Mitchell was the risking of his career in dispatching, with the help of two other officers, an anonymous letter to Air Corps officers encouraging pressure on their congressmen for a separate Air Force. As a result, Arnold was summarily reassigned from his position as Chief of the Information Service in Washington to Fort Riley, Kansas, a cavalry post in the eyes of most aviators not far distant from Elba or St Helena. In his memoirs written twenty-five years later Arnold reflected that 'we didn't think these things out'. He recalled that the 'idea of successfully employing bombers in mass formation to attack key industrial plants in the heart of enemy country was still far in the future'.⁹

If the evidence concerning Mitchell's influence on Arnold's ideas is not clear, it is certain that at the Army Industrial College and the Command and General Staff courses that Arnold attended between the wars, little insight was offered into the use of air power from curricula based primarily on rehashing the Army's ground experience in the First World War. Although

one author in an undocumented biographical sketch has written that by 1931, when he commanded March Field in California, Arnold was 'gaining a reputation as a bomber man', there is little evidence for this conclusion.¹⁰

Arnold's role as chief of the Western District during the Air Mail fiasco of 1934 must have acquainted him with the scepticism of the day, which questioned whether an Air Corps which seemed unable to transport mail a few hundred miles over friendly terrain could be capable of defence against attack or of bombing distant enemies. Although the bomb-sights developed by Norden and Sperry in 1933 were used by Arnold's pilots when he commanded March Field in the 1930s, there is little evidence at this time of his commitment to long-range bombing. As a counter to the adverse publicity from the air-mail crashes, the Air Corps chose Arnold to demonstrate the long-range capability of its modern B-10 bomber by leading the flight from Washington, DC to Alaska and back in 1934. On his return Arnold's recorded remarks did not reveal any appreciation of the strategic importance of the flight, the aviator dismissing it in a letter to his wife 'as just a job'.¹¹

The conclusion seems warranted, given the fact that Arnold was far from an ideologue, that when he assumed control of the Army Air Corps in September 1938, he may not have been wholeheartedly committed to the concept of strategic bombardment. On the other hand he had written in retrospect of the thirteen B-17s possessed by the AAF at this time that this aeroplane was 'the focus of our air planning, or rather of the Air Corps' fight to get *an* air plan – some kind of genuine air program – accepted by the Army'.¹²

Regardless of Arnold's commitment to the concept, doctrine emphasising strategic bombardment had been evolving at the Air Corps Tactical School. The school opened in 1920 soon after the Army Reorganisation Act of that year established the Air Service as a separate combat arm of the US Army, and its doctrine emerged slowly. Arnold never attended the course and there is little evidence to reveal his role, if any, in the differing views of the curriculum that were developing in the two decades between the wars. The predominant view that emerged by 1935 emphasised bombardment aircraft, presumably self-sufficient and not necessarily requiring accompanying fighter protection, as the major instrument for attack on an enemy's strategic areas. The appearance on 16 July of that year of the Boeing Model 299, the prototype of the B-17, provided the

aircraft that could implement the strategic bombardment theory. Even though the aircraft thought capable of attacking enemy strategic areas now existed, its basis for future employment was based on potential rather than experience. This resulted in an underestimation by Arnold and the Tactical School faculty of bombardment's shortcomings, and over-optimistic projection of its success.

Technological development, the students were taught, would produce the desired bomber (which Boeing appeared to have provided with the 299/B-17); but at the same time technological improvement was minimised or ignored as it pertained to the development of pursuit aircraft.¹³

One who did not embrace the bombardment theory as the *raison d'être* of the Air Corps was Claire Chennault, a fighter pilot whose heretical view was that the bomber would not 'get through' and would be destroyed by fighter planes with greater speed, manoeuvrability and fire-power. Although Arnold had written in 1933 while in command at March Field that 'the bombers will reach their objective with the pursuit having made but one attack' and 'it is obvious that pursuit tactics must be revamped or the pursuit passes out of the picture', his views in the latter part of the decade regarding Chennault are not clearly documented.¹⁴

A recent account of Chennault quotes, without documentation, Arnold asking in 1931 'who is this damned fellow Chennault?'¹⁵ Arnold's position in Washington as Assistant Chief of the Air Corps from 1936 to 1938 would have involved him in the retirement of the frustrated fighter pilot, and in Chennault's subsequently joining Chiang Kai-shek as his air adviser in 1937. Arnold's personal and official correspondence of the period fails to comment extensively on the zealous aviator, and in Arnold's autobiography no mention is made of Chennault until Arnold visited the latter in China in 1943.¹⁶ The reason for lack of mention may well have been that by 1937, with both the Norden and Sperry bomb-sights available, a fast four-engine bomber in production which was thought to be impregnable (hence a 'Flying Fortress', in the words of a Boeing publicist) possessing the ability to fly at altitudes assumed to be beyond the range of existing anti-aircraft fire and fighter attack, convinced Arnold that the opinions of the dogmatic Chennault were heretical in contrast to the doctrine being taught at the Tactical School. However there is little clear evidence of Arnold's views at this time.

By the Munich agreement of September 1938, when Arnold became Chief, it can be assumed that whatever his role in the formulation or acceptance of the doctrine, he was beginning to embrace its tenets. Arnold presumably approved the publicity accorded the potential strategic bomber when it was used to intercept the Italian liner *Rex* at sea, later bombed the USS *Utah*, and demonstrated its intercontinental abilities with a goodwill non-stop flight to South America.¹⁷ In short Arnold had to have been pleased with the seeming public acceptance of the B-17, even though Army procurement for 1939 was discouraging. The War Department decreed (many thought due to Navy pressure) on 9 August 1938:

No military requirement exists for the procurement of experimental pressure cabin bombers in the fiscal year 1939 or the fiscal year 1940, of the size and type described (four engine planes). The Chief of the Air Corps has been informed that the experimentation and development for the fiscal years 1939-40 will be restricted to that class of aviation designed for the close-in support of ground troops and for the production of that type of . . . light aircraft.¹⁸

Arnold, still Assistant Chief, noted: 'It is thought that the Chief of the Air Corps should fight this decision.'¹⁹

Nevertheless Arnold, like all human beings, was not consistent in his thinking. Less than three months after the outbreak of the Second World War in Europe he expressed some doubt about the pre-eminence of bombardment. As he wrote: 'A doctrine which has been widely propounded in certain Air Corps circles for many years, to the effect that pursuit aircraft and fighter aviation can be minimised on the basis that fit [fighter] a/c cannot shoot down large bombardment planes in formation, has not been proven wholly untenable.'²⁰ Curiously enough Arnold seemed to place some of the blame on the 'teaching of doctrine' in the Tactical School, one of his few recorded comments on that organisation. He transmitted his concern to the Air Corps Board to study and make recommendations for the development of pursuit aircraft to provide 'the protection of aircraft in flight'.²¹ Unfortunately the pace of events did not permit the same priority to be given to the development of fighters as was accorded bombers, and development and procurement of fighters languished, a near-fatal flaw in Arnold's leadership. As he confessed to West Point cadets in October 1941 'Frankly, fighters have been allowed to drift in the doldrums.'²²

If this 1938-41 interval was a period when Arnold questioned strategic bombardment, or at least the premise that the 'bomber could get through', by 1941 Arnold would appear to have resolved the issue, as articulated in his volume *Winged Warfare*. Published in that year and co-authored by his close friend and fellow aviator, Colonel Ira Eaker, the book was written to discuss 'the principal phases of air power and air defense', albeit with an eye to public interest and probably sales of a treatise on this timely topic. The book promised that it would 'suggest the form and shape and size of that bulwark for air defense' necessary 'to stop the present world-marauding air forces'.²³

According to the authors 'the bomber is the essential nucleus of an Air Force' and 'is distinctly offensive in character' as contrasted to the fighter, which was narrowly characterised 'as a defensive type of aircraft'. If the reader had any doubts he was informed that 'battles and wars are won by a vigorous offensive and seldom, if ever by the defensive'. The bomber developed in the US had been retarded, so they wrote, because it 'brought into being a weapon contrary to our military policy which had been traditionally conceived of as defense'. They concluded that the bomber, 'like a snake in the grass, is a particularly unpleasant fellow'. Eschewing attacks on civilian populations, they suggested that the 'most economical way of reducing a large city to the point of surrender, of breaking its will to resistance, is not to drop bombs in its streets, but to destroy the power plants which supply light, the water supply, the sewer lines'. They continued: 'It is generally accepted that bombing attacks on civil populace are uneconomical and unwise.'²⁴ The fighter versus bomber argument was concluded in this fashion by the authors: 'It is possible to build an air force purely defensive in character, consisting entirely of fighter aviation, on the theory that if a nation has enough fighter aircraft it can prevent the incursion of bombardment aviation. Wise air leaders now know that this is an untenable theory. Bombers are winged long-range artillery. They can no more be completely stopped once they have taken the air than the big shell can be stopped once it has left the muzzle. . . . Some will get through.'²⁵

If this volume published in 1941 represented Arnold's doctrinal commitment to strategic bombardment, the next step in preparing the nation to meet the war which most American military believed was just over the horizon for Americans, was planning a strategy for its implementation. Planning with the

British began as early as January 1941, almost a year before Pearl Harbor, and resulted in a report labelled ABC-1. The aviator representative of the US Army in these secret negotiations was Colonel Joseph McNarney, a veteran of six years at the Tactical School and commander of bombardment units under Arnold at March Field. Although he was the representative of the War Plans Division of the War Department in these negotiations, there is little doubt that his appointment was approved if not suggested by Arnold, and that the Colonel co-ordinated closely with Arnold and his staff during the conversations. McNarney's promotion to Brigadier General in the month following the submission of the ABC-1 report attests to his loyalty to the air arm and to the approbation of its leader.²⁶

The report was submitted in late March, and was a course of action drawn up 'should the US be compelled to resort to war', assuming its enemies would be Germany, Italy and Japan. Predicting that Germany was the strongest of these, the Atlantic-European area would be the 'decisive theatre', with the US Pacific Fleet utilised to weaken and presumably 'hold' Japan. Among the measures to be implemented against Germany was a 'sustained air offensive', possibly after attainment of 'superiority of air strength . . . particularly in long-range striking forces'. Bombardment enthusiasts welcomed the conclusion that 'US Army air bombardment units would operate offensively in collaboration with the Royal Air Force, primarily against German Military Power at its source'. This concept of strategic bombardment was further confirmed as strategy in RAINBOW No. 5, the US Joint Army and Navy War Plan completed the month following the submission of ABC-1.²⁷

Further planning in the summer of 1941 confirmed the AAF's and Arnold's commitment to strategic bombardment. President Roosevelt's increasing concern over the need for the nation to arm, and his view that air power was the most visible and quickly attained resource, prompted him to request that the military prepare an estimate of 'overall production requirements needed to defeat our potential enemies'.²⁸ Concerned that submission of an air annex to the War Department response would emphasise air power as a ground-support tactical force rather than in a strategic mode, Arnold was convinced by Lieutenant-Colonel Harold George to let the newly formed Air War Plans Division submit an Army Air Forces plan as a separate part of the Army response. George, who headed the Air War Plans Division, had been an aviator since 1918, and had seen little

activity outside the bombardment arena. He was reputed to have dropped more bombs than any other American aviator, and had served for five years as chief of the Bombardment Section at the Tactical School. Just prior to assignment to Washington in 1941 he had commanded the Second Bombardment Group, the only AAF unit possessing B-17 aircraft.

Joining George in the division were Haywood Hansell, Laurence S. Kuter and Kenneth Walker, all of whom had spent at least five years each in the previous decade as students and instructors at the Tactical School – hardly a coincidental gathering of bombardment enthusiasts. This group drew up what one of its authors has labelled *The Air Plan That Defeated Hitler*.²⁹ Following closely on the premises of ABC-1 and RAINBOW No. 5, it was decided in AWPD-1 (as the new study was officially labelled) to emphasise a strategic air offensive to debilitate the German war machine and topple the German state if possible, and to prepare for support of an invasion. It did not eliminate the possibility of achieving victory through strategic air warfare alone, or limit the effort to attain that objective. It placed prime emphasis on air power, including strategic bombardment.³⁰

It set forth in some detail a host of requirements necessary to achieve an 'unremitting and sustained air offensive against Germany', including identification of target systems in Germany and a priority for their destruction, the size and number of bombs required, and the allowances to be made for fighter impact on bombing. It was an amazing document, even allowing for the hyperbole of one of its authors, who wrote in retrospect: 'But if the task was staggering, so too was the opportunity. In a very real way, we sensed that the future of American airpower depended, in large part, on what we accomplished.' Completed in seven days, it was eventually approved up the chain of command and became a blueprint for the expansion and utilisation of the AAF. It was essentially accepted by the Combined Chiefs of Staff during the visit of Churchill and the British war leaders at the ARCADIA conference held in Washington during the weeks following Pearl Harbor.³¹

In September 1942 a revision of requirements was requested when Roosevelt asked the military for an estimate of aircraft requirements for the remainder of the war.³² One of the authors of AWPD-1, now a Brigadier General, was brought back from Europe to draft what became AWPD-42. As in AWPD-1, the philosophy of the Tactical School in the 1930s was still gospel to

the planners, and certainly now to General Arnold, who had committed considerable resources to the implementation of strategic bombing operating from the British Isles. Even though the empirical evidence, drawn from the ten bombing missions which had recently been flown by Americans from England over France, was very limited thus far, AWPB-42 concluded that:

It is perfectly feasible to conduct precise bombing operations against selected precision targets from altitudes of 20,000 to 25,000 feet, in the face of anti-aircraft artillery and fighter defenses. Our heavy bombers are far superior in firepower and capacity to absorb punishment to the bombers used by the Germans. Our daylight penetration of German defenses has up to this time indicated a relatively low attrition rate to our bombers and a relatively high attrition rate to German fighters.³³

No reference was made in either plan to the need for escort fighters. Doctrine dies hard in the minds of zealots.

It is difficult to imagine, even with the limited experience of the ten missions flown by the AAF from England, how AWPB-42 could have ignored the need for fighter escort; but as in AWPB-1, the rationalisation prevailed that the AAF could penetrate German defences in daylight even though German bombers had failed to achieve their goals in daylight attacks on Britain. Quite possibly the argument was as expressed in AWPB-1, that the technological superiority of the British fighter plane over the German bomber was the principal reason for the heavy losses of German planes . . . which accounted for the practical abandonment of Nazi daylight attacks.³⁴ AWPB-42 also emphasised the role that the AAF would concentrate its efforts upon – the systematic destruction of selected vital elements of the German military and industrial machine through precision bombing in daylight. The RAF would concentrate upon mass air attacks on industrial areas at night to break down morale.³⁵

By the beginning of American attacks from British bases in August 1942 Arnold seems to have become confident of the wisdom of strategic bombardment as a viable if not the only strategy. Nowhere in his writing does he seem to have perceived the Achilles' heels in this theory, which he had been embracing wholeheartedly since at least 1941. Among the weaknesses in the theory were that fighter escorts would not be necessary given the altitude, fire-power and formation flying of

bombers, and that somehow German morale would be more fragile than British, and would be more adversely affected than those who had successfully withstood the 'Blitz'. Another shortcoming in the strategy was the fallacy that British industry was more durable than German, since the former had obviously resisted Luftwaffe attempts at destruction.

Commencing nine months before Pearl Harbor, Arnold would undertake a series of trips abroad to witness first-hand the efforts of first the RAF and later the AAF to carry out the strategic bombardment theory. For the most part his travels appeared to confirm his convictions concerning strategic bombardment. The first of these trips was undertaken in the last three weeks of April 1941, and took Arnold to England. The ABC discussions had just been completed, Lend-Lease had been recently approved by Congress, appropriating \$7 billion for war *matériel*, much of it for aircraft procurement, and Arnold would have an opportunity of viewing at first hand the aerial warfare then taking place over the skies of Great Britain. The British, anxious to continue the largess which was beginning under Lend-Lease, co-operated fully. He was shown everything from the latest super-secret jet-engine development of Frank Whittle to their system of air defence, inspected aircraft factories and witnessed the preparation, take-off and debriefing of a bombing mission. He met with King George VI, spent a weekend with Winston Churchill, and had discussions with the British military chiefs and a host of others. Strategic bombardment was one of the main points of discussion and Arnold was informed by the British that daylight bombing over Germany was completely impossible.³⁶

During his stay in London he witnessed (from a closer vantage point than he desired) several German air raids over that city – which had a 'very profound' impact on him, as he saw the fires and destruction from the roof of his hotel. He appeared little 'impressed by their [British] Bomber Command. It was pathetic . . . in that their idea of what was big to us was little.'³⁷ His vignettes of British stoicism under air attack showed genuine concern for those brave people, but probably reflected an inconsistency which was to mark his thinking. He admired their 'determination not to be wiped off the map', but failed to appreciate that the same determination might well (and would) mark the German people in their reaction to American and British bombing.³⁸ If there was any doubt about the role of strategic bombardment before making the trip, his diary entry of

21 April seems clear: 'War is an air war today. The Air alone can bring the Germans to its [sic] knees if anything can. The Navy can only insure the existence of England, the Air can bring the war home to central Germany and break down morale.'³⁹

The attention Arnold paid to every aspect of RAF bombing from planning through to the completion of a mission revealed his intense interest in strategic bombardment. On his return home he directed a speeding up of the development of the B-29, thought of at the time as the only aircraft capable of reaching the furthest German targets, and was successful in getting the President to order, four days after his return, increased bomber production.⁴⁰ The inclusion of Arnold by the President as one of the American military invited to attend the Argentia Conference held with Churchill and his advisers in August 1941 in Newfoundland would be testimony that Roosevelt did not disapprove of Arnold's views on strategic bombardment. From this meeting until the end of the war Arnold was invited to attend every major diplomatic/military conference which Roosevelt attended, implicit recognition of the acceptance of General Arnold and his ideas by the American leader.

While at Argentia, Arnold became further concerned that the allocation of aircraft would not permit the AAF to develop a force large enough to implement strategic bombardment if the United States became involved in war. Decisions made before Argentia at the political level had dictated that as long as America remained technically neutral, first priority for the allocation of aircraft would be to the British, with lesser consideration to Russia (after the German invasion of June 1941), China, and then other supplicants. At Argentia, Arnold was dismayed that the British 'as usual asked for everything they wanted regardless of whether we have or ever will have an Air Force. They never blinked an eye when they asked for 100 per cent of our production.'⁴¹

After his return Arnold promulgated a solution allocating to American forces 32 per cent of the 13,174 planes to be produced, to the British 50 per cent, to the Russians 14 per cent, 3 per cent to China and 1 per cent to all others.⁴² This was the status of aircraft allocation by the time of Pearl Harbor. As the official AAF history expressed it: 'On the eve of the war the AAF was working under an allocation system which made impossible the early achievement of its program. The principle which since summer of 1940 had favored aid to the Allies over the needs of our air arm was clear enough.'⁴³

The ARCADIA conference held in Washington in the weeks following Pearl Harbor, with Churchill and his staff meeting with Roosevelt and the American chiefs did not weaken the doctrinal and strategic concepts of the AAF. There it was decided that the 'Europe first' strategy of ABC-1 was to be maintained in spite of American public opinion, which now sought more immediate revenge against Japan. The strategic bomber offensive against Germany was to be conducted, and a reallocation of aircraft production was proposed reflecting this changed set of circumstances.⁴⁴

Japanese advances in the early months of 1942 and the changing military requirements throughout the remainder of that entire year raised questions in Washington and elsewhere as to the desirability of a continuation of the 'Europe first' policy designating scarce air resources, particularly four-engine bombers, to be shipped to Europe for future operations, as contrasted to a perceived need for their immediate use elsewhere. The continuing shortage of four-engine aircraft and the changing strategy as the United States progressed from a defensive posture to an offensive one in 1942 continued to demand considerable skill on the part of Arnold in support of the concept of strategic bombardment.

Arnold continually sought to remind his superior, General George C. Marshall, the Army Chief of Staff, of the need to continue with the European build-up and the opening of the American strategic bombardment campaign in spite of the constant pressure for diversion of the bomber groups proposed for England to other theatres, particularly the Far East. One of his strongest pleas was written on 3 March 1942. His argument was that whereas we have dispersed aircraft world-wide as 'a matter of expediency', Japan's 'strength is relative, the strength of Germany is absolute'.

He argued that the American forces in the Pacific must be those 'capable of delaying action only'. He further indicated that the only aircraft capable of being flown to the Pacific were heavy bombers, and that their route to that area was subject to 'interdiction by the Japanese almost at will', and even after arrival their bases were subject to attack. He insisted that offensive action in the Pacific was 'precluded by considerations of logistics and security'. In contrast the lines of communication to the British Isles were secure, the distance to future bases there was much less than in the Pacific, and ferrying of both medium and heavy bombers to that theatre was possible. His final conclusion

left no doubt as to his priorities: 'I strongly recommend that we immediately adopt the policy of building an effective air force in the British Isles for offensive action against Germany proper.'⁴⁵

Arnold maintained his concern for implementation of the concept of strategic bombardment when he travelled to England in May 1942, this time with a mission to attempt to renegotiate the allocation of aircraft between the British, the Army Air Forces and the United States Navy. The result was a reduction in the number of four-engine bombers to be provided to the British (and now used essentially for anti-submarine work with the RAF Coastal Command) and an unwillingness to increase extensively the numbers of four-engine aircraft requested by the US Navy for patrol and anti-submarine operations in the Pacific.⁴⁶

In terms of the impact of a bombing offensive upon civilian morale, Arnold was struck during his May-June 1942 visit by the contrast with the previous year, when London was under attack by German bombers. This time he found Londoners smiling with 'that look of almost fearful bewilderment gone . . . pianos are playing, men are whistling, London is changed', since 'the Huns have not been here for about a year'. On the other hand, he had been informed by two ranking officials that 'with another week's blitz (last year by the Luftwaffe) both London and Liverpool would have folded up'.⁴⁷ He insisted upon maintaining the priority for strategic bombing by the Americans, indicating to the British leadership that the 'whole question had to be decided upon as to which use was the more important, using heavy bombers to carry bombs into Germany or go out hunting for submarines'.⁴⁸ If Arnold had any doubts, Ambassador John G. Winant sent back with Arnold a message to Roosevelt: 'England is the place to win the war; get planes and troops over as soon as possible'.⁴⁹

While Arnold was *en route* home the battle of Midway was taking place, and although Arnold and his travelling companion Averell Harriman could not yet know of its outcome, they were both concerned that the threat now seemingly posed by the Japanese would not permit sending to England the aircraft required to implement the strategic bombardment concept. As Arnold recorded in his diary: 'One of the greatest fears of Churchill' (and he might have added one of Arnold's), 'is that we will not be able or will not send over the planes we plan . . . he fears just what has happened [the Japanese threat] . . . delaying the movement.' As to Harriman's thoughts, Arnold

recorded: 'He has the same fears that I have; we are so afraid of a Japanese raid that we are apt to postpone our main objective. That must not be.'⁵⁰

Although Arnold was successful in reducing the number of four-engine aircraft allocated to the British, Churchill accepted this decision while on a visit to the United States and on the day Tobruk fell to Axis forces. By 25 July the decision had been made to postpone any invasion of Europe for the remainder of 1942, which lessened (in the minds of many but not Arnold) the importance of starting the strategic bombardment offensive by American aircraft from British bases. Instead planning began for an autumn invasion of North Africa code-named TORCH, to relieve pressure in the Mediterranean and on the Russian front. At the same time Navy and Marine forces were planning the Guadalcanal landing for early August. Arnold remained steadfast in his belief, shared in part by Marshall and Roosevelt, that the necessity remained for a visible showing of American strength against the continent of Europe, and the strategic air offensive appeared among the most viable alternatives available. The unsuccessful and foolish raid ordered by Roosevelt by six American light bombers against Dutch airfields from England on the symbolic fourth of July seemed to Arnold to confirm the White House desire for visible accomplishments through aerial attack.

The planned operations made it clear that there were not sufficient resources, particularly four-engine bombers, to support the planned TORCH invasion, meet Navy demands for support in the Pacific and commence a strategic air offensive from English bases. Arnold opposed the proposed North African landings as a diversion from commencing an assault on Germany proper as strongly as his loyal relationship to Marshall would permit, and he predicted the chances of success of TORCH at less than 50 per cent.⁵¹ Once however the Guadalcanal operation, which had begun on 7 August, bogged down, and the demands for increased heavy-bomber support in the Pacific grew louder, Arnold supported the North African invasion as one that could be viewed as ancillary to the European theatre, since it would be attacking German air strength and American aircraft could be returned to English bases once success had been achieved. Arnold went so far as to encourage letters from Portal, Patton, Eisenhower and other ground commanders to Marshall pointing out the need to retain air assets in Europe for the North African invasion and the later strategic air

bombardment against the Continent, rather than see their allocation to the Pacific theatre.⁵²

In the mean time the Eighth Air Force had finally launched its first heavy-bomber mission against German-occupied Europe, sending twelve B-17s on 17 August 1942 against a French airfield in the Rouen area.⁵³ Any elation over this meagre beginning of the bomber offensive from England was tempered by news of the American defeat in the Pacific a week earlier at the Battle of Savo Island, possibly the worst defeat suffered by the United States Navy. The losses initiated ever-greater pressure by the Navy for additional aircraft, specifically heavy bombers for the Pacific area. Arnold's frustration is mirrored in his diary entry of 16 September 1942, when he wrote:

Navy wants to send in more and more planes [in the Pacific] apparently with view of making that their main theatre by employing most of our aircraft. Southwest Pacific can never be anything but minor theatre until Germany is beaten. Our policy must be to build up air strength against Germany until we break her morale, defeat her air forces, destroy her industrial capacity to produce, and render immobile her transportation. Our day bombing and the British night bombing have demonstrated that we can do those things to Germany if we do not disperse all over the world.⁵⁴

The demands to shift aircraft to the Pacific became so great that the Joint Chiefs of Staff (JCS) delayed a decision until Arnold could undertake a gruelling sixteen-day trip to that theatre and report back to Washington with his analysis.

Arnold had a healthy suspicion of the United States Navy dating from the between-the-wars period when the debate over roles and missions, separate status for the air arm of the United States Army, and the desired utilisation of land-based versus carrier-based aircraft appeared as vital issues. Little love was lost between Arnold and the leader of the Navy, Admiral Ernest J. King. The acerbic admiral, who reserved his few courtesies for women to whom he was not married, had not learned to fly until the age of forty-nine in the rank of Captain, and had never flown an aircraft by himself after leaving flight school. King's attitude towards Arnold and the Army air arm was never in doubt, the admiral evaluating Arnold as someone who 'didn't know what he was talking about' and as a 'yes man for Marshall'.⁵⁵ As early as 1941 King had written to a fellow naval officer that 'I sincerely hope that this matter of a separate air

force will not break out into the open, although I feel confident that while it would prove troublesome for a time, ultimately we would be able to have others see it our way.⁵⁶

On his trip to the Pacific theatre, which took him from Washington all the way to Australia, Arnold found a constant theme from both naval and army officers. Admiral Nimitz in Hawaii told Arnold 'that war can be won in the Pacific, that bombardment of Germany is of no use'.⁵⁷ Other naval officers echoed similar sentiments, telling Arnold that 'your bombers are doing no good over in England. Your fighters are being wasted in Europe. Here is where they can be of use. Here is the only place where they can get results.'⁵⁸ Even MacArthur, whom Arnold found 'obsessed by a plan he can't carry out' described England as a 'besieged citadel' from which no 'second front can possibly be established'.⁵⁹

The reallocation of aircraft made by the JCS following Arnold's return from the Pacific was disappointing to the strategic-bombardment advocate, but since units withdrawn from the proposed build-up in Europe were to be kept in strategic reserve, Arnold at least was optimistic that they had been kept from being shipped to the Pacific, from where, at least in his own mind, there would have been no return.⁶⁰ From his arrival back in the United States from the Pacific on 2 October until the Casablanca agreement in January 1943 Arnold spent considerable effort in attempting to continue the commitment to strategic bombardment which only could be met by building up the bomber force in England.

In these efforts Arnold utilised every opportunity of pointing out to those in the decision-making process the logic of the agreed-upon strategy. Although he had some reservations about the final JCS decision on the numbers of aircraft to be produced for the year 1943, he had little hesitation in dealing directly with Roosevelt in order to secure the president's support for the 'highest priority' for the proposed 107,000 aeroplanes.⁶¹

Although often his communications with Harry Hopkins, the confidant of Roosevelt, were oral rather than written, Arnold rarely hesitated in using this 'channel' of communication to influence decisions. Hopkins was present with Arnold at dinner with Churchill the night the RAF sent its first thousand-plane raid against Germany.⁶² The breakfast meeting with Hopkins at the Casablanca Conference on 19 January 1943 would not be untypical of their meetings and conversa-

tions, and Hopkins appeared receptive to Arnold's strategic-bombardment arguments.⁶³

His constant exchanges with the Chief of Staff, General Marshall, indicate the airman's interest in securing as much support as possible from this influential member of the JCS. The theme in these communications remained constant, that Germany was the strongest enemy of the Allies and that strategic air bombardment against her industrial heart and the destruction of her war-making potential were the only ways to ensure the success of the projected invasion of the Continent. Not untypical of Arnold's pleas was the claim that 'if *decisive* results are ever to be attained in this war, offensive operations against the center of Axis strength, *industrial Germany*, must be continued relentlessly from now on, and from every possible base'.⁶⁴

Arnold continued to present the JCS with papers and background material to substantiate the need to continue the strategy of bombardment and 'Europe first'. Occasionally he would confide his discouragement in memos for the record, which presumably did not circulate. Nevertheless they show his occasional pessimism over support for strategic bombardment, as he felt that none of the JCS leadership 'in spite of every protestation that we could make . . . seemed to think in terms of winning the war. All seemed to think in terms of meeting the easiest enemy first'.⁶⁵ In papers presented for consideration by the JCS, Arnold normally attempted to bring to their attention the latest results from the bombing, which had been going on since the 17 August raid against Rouen, France. His most telling arguments were summarised in his memo of 16 November 1942, which subsequently became JCS 152. Arnold argued that bombing was 'the only practical means open' to attack Germany. He recommended that the JCS 'accept the strategic principle that the main effort of the United States be directed toward the defeat of Germany while maintaining present holdings against Japan' and that 'the air offensive against the European Axis be pressed to the limit of our capacity'.⁶⁶

At the same time Arnold was in constant communication with his two immediate commanders, Generals Ira Eaker and Carl Spaatz, who were on the scene in England directing the beginning of the American strategic bombing offensive. The very fact that Arnold had sent his two closest friends and associates to command the Eighth Air Force and Bomber Command is indicative of the importance he accorded the concept of daylight bombing. Nevertheless his displeasure at what he viewed as

their slow beginning and their limited success, particularly in view of what Arnold felt were the stakes involved, is clear in their correspondence. His displeasure with the Eighth Air Force commander's progress would eventually lead him to relieve General Eaker, his close friend and co-author, just before the beginning of 1944. The theme of their correspondence was the problems and successes of the early raids, plus the difficulties associated with dispersion of forces to TORCH and proposed reallocation to the Pacific. The responses from the commanders in England generally emphasised their limited successes, the ability of the bombers to defend themselves against German fighter attacks and the problems associated with the early operations. Between the lines, however, Arnold's impatience, which became much more clearly expressed after Casablanca, began to show. As he wrote to Spaatz in November: 'Unless we are careful, we will find our air effort in Europe dispersed the same way we are now dispersed all around the world. . . . This must be prevented.'⁶⁷

As a counterforce to the publicity that the press was according to the difficult struggle in Guadalcanal, which had dominated the headlines since the 7 August invasion, Arnold attempted to get more coverage of the early raids against the Continent by American bombers. Only ten days after the first raid, efforts were undertaken to have Spaatz and 'Bomber' Harris of the RAF meet with the editor of the *New York Times*. Spaatz felt that he had convinced Sulzburger of 'the efficacy of air bombardment' and secured the agreement of the newspaperman to publish 'full page pictures of bomb damage' in his newspaper. Arnold, never forgetting the value of public relations when he had directed that activity for the Air Corps during the Billy Mitchell court-martial trial, eagerly attempted to work with this influential newspaper to publicise the beginning work of the Eighth Air Force.⁶⁸

By November Arnold was not completely satisfied that the story of the 'true potentialities of air power' was being presented to the American people. As a consequence he assigned to the staff of General Eaker the former editorial chief of the *New York Daily Mirror*, who had formerly been editor of the *Literary Digest*. This officer's task was to originate material in England for use in the United States 'to demonstrate just what our long range and heavy bombers are doing and are capable of doing'. Arnold had great confidence in this officer, who had 'a deep understanding of the capabilities of air power, particularly as concerns the

heavy bomber in its mission in the European theater'. Lest there be misunderstanding about the task involved Arnold cautioned Eaker: 'For obvious reasons, please treat this letter as one of strict confidence between you and myself. I am sure you can realize the effect of its misinterpretation.'⁶⁹

At the same time that Arnold was paying careful attention to the strategic bombardment offensive beginning over European skies, he was candid in informing commanders elsewhere as to why their theatre had a lesser priority than that of the Eighth Air Force in England. Exemplary is his correspondence with feisty General George C. Kenney commanding MacArthur's air forces in the Pacific. Though they were old friends, Arnold had visited that theatre in September 1942 and remained unconvinced as a result of his journey that the overall strategic concept of 'Europe first' and a 'holding' action in the Pacific should be changed. As he wrote to Kenney on 6 December 1942: 'the overall strategic picture does not permit that every theatre be considered from an offensive viewpoint'. He promised 'to keep your forces at sufficient strength to enable you to support yourself defensively and to carry out a limited offensive against the Japanese'. Arnold felt that as a result of successes in North Africa and Russia Hitler needed to be hit 'before he can recover and consolidate'. As he concluded: 'Every hour and every airplane counts now, and any diversion from our European forces cannot appear to be justified.'⁷⁰

In concluding Arnold's quest for acceptance of strategic bombardment as a viable theory, the agreement by Roosevelt, Churchill and the Combined Chiefs of Staff on the Combined Bomber Offensive at the Casablanca Conference in January 1943 marked success for this dedicated airman. It is beyond the space limitations of this chapter to cover in detail the negotiations at Casablanca, but they marked the acceptance of strategic bombardment as the major mission of the AAF. It seems curious to this student that Arnold, generally very careful in noting details in his overseas diaries, pays so little attention to this decision which marked the culmination of his struggle for a *raison d'être* for the AAF. He pays a bit more attention in *Global Mission*, but even in that account the agreement by Churchill and others and its significance in the resultant Combined Bomber Offensive (which does not even appear in the index to *Global Mission*) earn only a brief treatment.⁷¹ Many explanations could be offered. Possibly the most logical is that Arnold in writing the diary was concentrating on his trip to China, and at Casablanca he had

more of a staff with him than on previous overseas trips. These subordinates were responsible for transmitting to Washington the details and the necessary paperwork for implementation of the Combined Bomber Offensive.

In summary, Arnold was a zealot in supporting strategic bombardment, although his advocacy of this policy was not consistent throughout his long career. On a comparative basis with the air chiefs of other nations, his problems were unique. More than in any other nation, the United States Army's air arm needed a *raison d'être* as the Second World War loomed on the horizon. The fortuitous combination of the development of an aeroplane capable of delivering destruction to a distant enemy and the public perception as heinous of the nations that became America's Second World War enemies permitted American public opinion to change from viewing their military as strictly defensive to seeing it as a destructive offensive force. In striving to develop, justify and implement daylight strategic bombardment Arnold found it necessary to do battle at the highest political and military levels in both Britain and the United States.

Yet this was not the struggle of an ideologue but of a pragmatist. Arnold never conceded that he ever read Douhet. However, like all zealots, Arnold was myopic. He failed in his view of daylight strategic bombardment in several areas. Among them was his shortcoming in believing in the defensive power of the bomber force and underestimating the offensive capability of fighter aircraft. Potential technological development which was predicted for the bomber force was not accorded fighters. In assessing the morale of those subjected to strategic bombing, Arnold was remiss in not appreciating that the resolve of the Germans could be as strong as that of the English victims whom he viewed first-hand under siege. He failed to appreciate the ability of the Germans to decentralise their industries, their recuperative power following bombing, and their ability to effectively alter their tactics to meet the American aerial onslaught. Although the evidence is not completely clear, Arnold's faith in strategic bombardment at least hinted that this methodology could well be sufficient to negate a ground invasion of the Continent.

Yet as time passed he developed a more realistic approach to the magnitude of the problem involved (plus an appreciation for the political support necessary from the United States Army, of which he still remained an integral part) and changed his thinking to advocating the destruction of German industrial capability

and the Luftwaffe fighter force as prerequisites for a successful invasion of the Continent. He could not have appreciated the role that the stepchild of strategic bombardment, massive retaliation, would play in the foreign and military policy of the United States in the four decades since the Second World War, but the achievement of aerial superiority in Europe and the role of bombardment (note I did not use the term strategic bombardment) in bringing the war to an end in the Pacific are tributes to Arnold's faith and accomplishments from 1941 to 1943.

Notes

1. See Thomas M. Coffey, *Hap: The Story of the US Air Force and the Man who Built It*, General Henry H. 'Hap' Arnold, New York, 1982, p. 167.
2. Arnold, 'Pioneers of the Aerial Trails', unpublished manuscript, Arnold Papers, Library of Congress, p. 12. This collection is hereinafter referred to as AP.
3. There are several letters in AP conceding Arnold's fear of flying. See for example Arnold to Commanding Officer, Aviation School, 6 November 1912, AP.
4. His diary in the First World War period runs from 30 September to 18 December 1918, AP.
5. H. H. Arnold, *Global Mission*, New York, 1949, p. 37, cited hereinafter as GM.
6. Arnold talked with Mitchell on 16 and 17 November 1918 in France: see First World War Diary, AP; Arnold's account of his relations with Mitchell is in GM pp. 42-3, 85-7 and 119-22.
7. Quoted in DeWitt S. Copp, *A Few Great Captains: The Men and Events That Shaped the Development of the U.S. Air Power*, Garden City, New York, 1980, p. 39.
8. *Ibid.*, pp. 44-5.
9. GM, pp. 122, 110.
10. Colonel Flint O. DuPre, USAFR, *U.S. Air Force Biographical Dictionary*, New York, 1965, p. 9.
11. Arnold to Mrs H. H. Arnold, 29 June 1934, AP.
12. GM, p. 156.
13. The best account of the school and its teaching is Robert T. Finney, *History of the Air Corps Tactical School 1920-1940*, Maxwell Air Force Base, Ala., 1955. See also Thomas A. Fabyanic, 'A Critique of United States Air War Planning, 1941-1944', unpublished Ph.D. dissertation, Saint Louis University, 1973.
14. Untitled paper, 1933, AP.
15. Quoted in Jack Samson, *Chennault*, New York, 1987, p. 9.

16. Even during this Second World War visit, Arnold is not very laudatory of Chennault. See Diary, 9 January–17 February 1943, AP.
17. See GM, p. 176.
18. Quoted in General Curtis E. LeMay with MacKinlay Kantor, *Mission with LeMay: My Story*, Garden City, New York, 1965, p. 141.
19. Quoted in Copp, *A Few Great Captains*, p. 433.
20. Arnold to CG, GHQAF, 14 November 1939, AP.
21. Memo for the Chief of Staff from General Arnold, 25 September 1940, AP.
22. Quoted in Samson, *Chennault*, p. 9.
23. Major General H. H. Arnold and Colonel Ira C. Eaker, *Winged Warfare*, New York, 1941, p. xiii.
24. *Ibid.*, pp. 133–4.
25. *Ibid.*, pp. 144–5.
26. See the biographical sketch in DuPre, *U.S. Air Force Biographical Dictionary*, pp. 155–7.
27. See the discussion in Wesley Frank Craven and James Lea Cate (eds), *The Army Air Forces in World War II*, 7 vols, Chicago, 1948–58, Vol. I, *Plans and Early Operations*, 1948, pp. 135–49.
28. Roosevelt to Service Secretaries, 9 July 1941, copy in AP.
29. Major General Haywood S. Hansell, jun., *The Air Plan that Defeated Hitler*, Atlanta, privately printed, 1972. There are excerpts from the plan in his Appendix IV, pp. 298–309. A copy of the plan is in AP. Note that the fortunes of the four authors in terms of promotion were not harmed by their authorship. For example George, a Lieutenant Colonel at the time, became a Lieutenant General by the end of the Second World War; Hansell went from Major to Major General, but was relieved by Arnold in 1945 for lack of progress in the strategic operations of B-29s in the Pacific; Kuter, then a Major, became a four-star general; and Walker, then a Lieutenant Colonel, was a Brigadier General when killed in action in 1943. Those who displeased Arnold did not fare this well.
30. *Ibid.*, pp. 75–6.
31. *Ibid.*, p. 69.
32. *Ibid.*, p. 100.
33. *Ibid.*, pp. 106–7.
34. AWPd-1, Tab 1.
35. Hansell, *The Air Plan that Defeated Hitler*, p. 170.
36. Arnold Diary, 9 April – 30 April 1941, AP.
37. Oral History Interview, Lieutenant General Elwood P. Quesada, 20 November 1960, Columbia University Oral History Collection, New York, NY.
38. Arnold Diary, 9 April – 30 April 1941, AP.
39. *Ibid.*
40. GM pp. 241–4.
41. Arnold Diary, 14 August 1941, AP.
42. Craven and Cate, *The Army Air Forces in World War II*, Vol. I, pp. 134–5.
43. *Ibid.*, p. 135.
44. Maurice Matloff and Edwin M. Snell, *Strategic Planning for Coalition Warfare 1941–1942*, Washington, DC, 1953, pp. 97–112.
45. General Arnold to Chief of Staff, Subject: 'Employment of the Army Air Forces', 3 March 1942, AP.

46. See the discussion and the specific allocations in Craven and Cate, *The Army Air Forces in World War II*, Vol. I, pp. 568-70. The most extensive British coverage of the agreement is provided in Sir John Slessor, *The Central Blue: The Autobiography of Sir John Slessor, Marshall of the RAF*, New York, 1957, pp. 404-15. Curiously enough Arnold provides little coverage of this important agreement, touching on it only briefly in GM, pp. 395-7.
47. Arnold Diary, 26, 30 May 1942, AP.
48. Ibid., 27 May 1942.
49. Ibid., 1 June 1942.
50. Ibid., 3 June 1942.
51. Arnold to Chief of Staff, 19 August 1942, AP.
52. See for example Arnold to Carl A. Spaatz, 19, 25 August 1942, with Arnold suggesting that Spaatz get Portal involved; also General James H. Doolittle to General George S. Patton, 25 August 1942, AP.
53. There is an account of the raid in Roger A. Freeman, *Mighty Eighth War Diary*, New York, 1981, pp. 9-11.
54. Arnold Diary, 16 September 1942, AP.
55. Quoted in Thomas B. Buell, *Master of Sea Power: A Biography of Fleet Admiral Ernest J. King*, Boston, 1980, p. 404.
56. Quoted *ibid.*, p. 365.
57. Arnold Diary, 21 September 1942, AP.
58. Ibid., 24 September 1942.
59. Ibid., 25 September 1942.
60. See Minutes 38th meeting, JCS 20 October 1942 and 39th meeting, 27 October 1942, copies in AP.
61. Arnold to FDR, 19 August, 24 August, 8 October 1942, AP.
62. See Arnold Diary, 27 May 1942.
63. See Arnold Diary, 19 January 1943, and Robert E. Sherwood, *Roosevelt and Hopkins: An Intimate History*, New York, 1950, pp. 681-2.
64. Emphasis in the original; memo for the Chief of Staff from General Arnold, 19 August 1942. Many other examples could be cited, such as similar memos dated 21 August, 22 August, 24 August and 5 September 1942. A review of the correspondence would lead to the conclusion that Arnold felt his superior needed to be frequently reminded of the problems and stakes involved in the case for strategic bombardment. Curiously enough, however, even after the decision had been made at Casablanca to give the 'green light' to strategic daylight bombing, Marshall occasionally questioned the priority of bombers to England. See for example Marshall's 30 April 1943 memo to Arnold which asked: 'Why send bombers to England: why not to Burma and Kenney?' and Arnold's four-page reply sent the very next day summarising the arguments for continuation of daylight strategic bombardment from England and concluding: 'We should stand steadfast against any further diversion from the bomber effort out of the United Kingdom against German industrial targets.' All correspondence is in AP.
65. Memo for the Record, 11 August 1942, AP.
66. See memo to be read by General Arnold at CCS meeting, 4 September; memo from Arnold to the JCS, 10 September. The quotes are from 'memo to the JCS', 16 November 1942, all in AP.
67. Arnold to Spaatz, 15 November 1942, AP. The correspondence is voluminous,

and a cursory count shows more than sixty letters passing between the three men in the last four months of 1942, all in AP.

68. See Spaatz to Arnold, 29 August 1942, and Arnold's undated reply, AP. A minor personal footnote: the author of this paper flew a combat tour in the Eighth Air Force as a nineteen-year-old Lieutenant in 1944, and remembers well the bantering which relatively unheralded American aviators serving in the Fifteenth Air Force from bases in Italy sang to a then-popular song. The original lyrics were: 'It's still the same old story, a fight for love and glory, a case of do or die.' The Fifteenth Air Force aviators insisted that their own lyrics reflected the disparity in the publicity accorded the two Air Forces when they sang: 'It's still the same old story the Eighth gets all the glory and all we do is die.'
69. See Arnold to Eaker, 18 November 1942, AP.
70. Arnold to Kenney, 6 December 1942, AP.
71. GM, pp. 395-8.

33

The Determination of RAF Policy in the Second World War

Henry A. Probert

Evolution 1918–1939

The first essential to the understanding of how the Royal Air Force was organised and directed in the Second World War is to appreciate that it was a unitary Service, equal in status with the two older Services. Indeed it had held this position ever since April 1918, and although it had had to fight hard to retain its independence in the early 1920s, at a time when resources were scarce and the pressures to dispense with the third Service intense, its position was in 1939 virtually unchallenged.

In part this was because the two main roles that were perceived for it in the inter-war years were largely separate from the roles of the Navy and Army. Strategic bombing had been seen from Trenchard's day as the chief *raison d'être* for the independent RAF, and from the mid-1930s the air defence of the United Kingdom was also regarded as an increasingly important role; on the other hand – partly because the Army itself did not until 1938 seriously envisage fighting another continental war – the role of Army co-operation was given little attention. Nor was the maritime role given high priority; the Royal Navy, which had never reconciled itself to the loss of its own Air Force, eventually succeeded, in 1937, in winning the argument for the return of the Fleet Air Arm to its own control, but with all the attention concentrated on the debate over ship-borne aircraft, relatively little effort was devoted to land-based operations. So the RAF in 1939 was largely a bomber and fighter force, though it must be remembered that it also had a number of squadrons based overseas, mainly in the Middle East, India and Singapore.

Its organisation reflected this emphasis. In 1936 the system of command whereby all the operational squadrons in the UK

were controlled by one headquarters, namely the Air Defence of Great Britain, had been replaced by a system of functional commands. Thus Bomber, Fighter and Coastal Commands now covered their stated functions, each being subdivided into Groups. Those in Bomber Command were each equipped with one particular type of aircraft, while those in Fighter and Coastal Commands were each responsible for a specific operational area. There were four further home commands: Balloon Command, which had an ancillary role in home defence, and Training, Maintenance and Reserve Commands, which dealt with the essential support areas. Overseas the organisation was different, in that all the units in a particular geographical area, regardless of role, came under the same headquarters.

The merits of this pattern of Commands would be seen as the war progressed; overseas the unified command of all the air forces in a theatre would give the air commander a complete all-purpose air force, and facilitate co-operation with the other Services that were based in the same area. At home in the UK the three functional commands would provide the almost ideal organisations to direct the strategic bomber offensive, fight the Battle of Britain, and work with the Royal Navy in the Battle of the Atlantic; but they could not properly accommodate the other air-power roles. Consequently further commands had eventually to be created to handle these, in particular Army Co-operation Command, which was formed in November 1940, its successor the 2nd Tactical Air Force which was created in June 1943, and Ferry Command, which was established in July 1941 and later became Transport Command. The fact that such important organisations did not exist in the earlier part of the war is a clear indication of the way the RAF was at first orientated, and goes some way to explain why effective land-air operations took so long to develop. On the other hand, scarcity of resources in these earlier days made it impossible to do everything.

The various Commands that existed at home and overseas were thus responsible for running the RAF's operations and providing the necessary support in terms of training and maintenance. Determination of RAF policy, on the other hand, was the concern of the Air Ministry in London. This, like the Admiralty and the War Office, was a Department of State, headed by the Secretary of State for Air, a politician who was a member of the Cabinet and answerable to Parliament for the affairs of the RAF. He also presided over the Air Council, which comprised the Chief of the Air Staff (the professional head of the RAF),

several other very senior officers who were in charge of specific departments, and the Permanent Undersecretary, a high-ranking civil servant who was responsible for the administration of the Air Ministry and the control of its finances. They and their various staffs were concerned with virtually all aspects of policy and planning. For example, they issued the necessary operational directives to the Commanders-in-Chief at the Command Headquarters, they oversaw the development and supply of aircraft and all the supporting equipment, they were responsible for recruiting, training and all the other aspects of manpower, and they dealt with the organisation of the RAF and its building programme. They also liaised with other government departments on matters of mutual interest.

Particularly important, of course, were the links with the Admiralty and the War Office and the organisation that was charged with the overall direction of the nation's military strategy, the Committee of Imperial Defence (CID), which was chaired by the Prime Minister. While there was no Minister of Defence as such, from February 1936 onwards there had been a Minister for the Co-ordination of Defence who chaired the CID's more important sub-committees, and it was Sir Thomas Inskip, who held that post, who decided in 1937 that the Fleet Air Arm must be transferred to the Navy and insisted, against the advice of the Air Ministry, that greater priority must be devoted to the production of fighter aircraft.

Probably the most significant of the CID's sub-committees was the Chiefs of Staff Committee, set up after the Salisbury Report on the Organisation of Defence in 1923. It was in this forum that the professional heads of the three Services consulted each other on the major matters that affected them jointly, and answering to them were the Joint Planning Sub-Committee¹ set up in 1927 and the Joint Intelligence Sub-Committee (1936) both of which included the responsible officers from the single-Service departments. But as the official historian says:² 'for most of the time during the inter-war years each of the three Services appears to have developed its own strategic thought and planning largely in isolation from the other two, content to accept the combined end-product as long as independence was not threatened in the process'. There was thus lacking any real attempt to look at the United Kingdom's military strategy as a whole; but at least there was a reasonable degree of understanding and co-operation between the Chiefs of Staff and the politicians; as the official historian goes on to

say:³ 'if Hitler made major strategic decisions against the advice of his generals the same could not be said – for good or ill – of the British Prime Minister and his Chiefs of Staff'.

The international dimension also needs mentioning. The war if it came would be fought in alliance with France, and as a part of wide-ranging Anglo-French discussions in the Spring of 1939 (remarkably late in the day, as it now appears), joint plans were drawn up between the two air forces for the deployment of RAF squadrons to France on the outbreak of war. Moreover, the very name 'Committee of Imperial Defence' reminds us of the close ties that existed with the other members of the British Commonwealth, whose governments were represented in many of the pre-war discussions about defence policy, and with whose armed forces the British Services, including the RAF, had many ties.

The Outbreak of War

The outbreak of war in September 1939 brought no major changes in the higher command structure as it had developed in the immediately preceding years, except that the functions of the CID were taken over by the War Cabinet, which was itself reduced in size to nine members, i.e. those holding the key posts that were directly relevant to the prosecution of the war. One of them was the Secretary of State for Air, Sir Kingsley Wood. The Chiefs of Staff Committee became answerable directly to the War Cabinet, and although its working procedures were not as efficient as they became later in the war it now occupied a central position in the national decision-making process. The key principle, as Slessor states,⁴ was that the man who gives advice to the Cabinet must be the same man who has ultimate responsibility for putting it into effect. Its chairman, who held the post by virtue of his seniority over the Navy and Army members, was Air Chief Marshal Sir Cyril Newall, who had been Chief of the Air Staff (CAS) since September 1937, and thus closely involved in the pre-war expansion schemes and the attempts to make the RAF ready for war. Having worked with Trenchard during the First World War in leading the Independent Force he was essentially a believer in the doctrine of strategic bombing; while he also came to recognise the importance of providing fighter defences for the homeland, he had been opposed to the acceptance of a continental commitment

on account of the enormous drain it would impose upon the RAF's slender resources. Despite this it was on his initiative, according to Slessor,⁵ that the Chiefs of Staff (COS) had asked in early 1939 to be allowed to discuss future plans with the French.

Newall's two principal operational commanders on the outbreak of war were Air Chief Marshal Ludlow-Hewitt at Bomber Command and Air Chief Marshal Dowding at Fighter Command. Ludlow-Hewitt had been at Bomber Command since 1937, where he had done his utmost to modernise his force and train it for war, but had also drawn repeated attention to its many weaknesses; certainly he had no doubts that, as the official history states:⁶ 'in 1939 Bomber Command was not trained or equipped either to penetrate into enemy territory by day or to find its target areas, let alone its targets, by night'. Consequently, as Slessor observes,⁷ 'conservation of the Bomber Force had become a determining factor in RAF policy'. In due course that force would grow into the great weapon that Harris would wield with telling effect, but in the earlier part of the war its achievements would bear no relation to what the advocates of strategic bombing had looked for.

But if Ludlow-Hewitt's command fell far short of expectations, Dowding's fighter force would surpass them. Dowding had been at Fighter Command since 1936, where he had been largely responsible for building up the control and reporting system whereby the fighters could be enabled actually to locate and intercept their targets. He too had maintained incessant pressure on the Air Ministry to provide the resources and improvements he needed, often making himself very unpopular in the process, but the 'system' he had created eventually proved strong enough – just – to win the Battle of Britain. That was really his greatest achievement; but it must be coupled with his utter determination not to allow his fighters to be lost in France.

The Battle of France

This was in fact the biggest strategic problem that the RAF faced in the early part of the war. In order to provide air cover for the British Expeditionary Force (BEF) and also to give general support for the land battle, some 25 squadrons were sent to France in 1939; 13 of these, including the Army co-operation and reconnaissance squadrons, were under the direct control of the

BEF, while the remainder – the light bombers and their two protecting Hurricane squadrons – were directly controlled by Air Marshal Barratt, the Air Officer Commanding-in-Chief (A.O.C.-in-C.) of the British Air Forces in France (BAFF). As events in May–June 1940 proved, this was for many reasons a totally inadequate force even when set alongside the French Air Force, and Barratt – who had to try to work with the Army commanders and of course with his French opposite numbers, as well as keeping in touch with Newall in London – was in an impossible position. On several occasions during the Battle of France, urged on by General Vuillemin, he pressed for further fighter reinforcements to be sent from the UK; but the RAF leadership in London viewed things differently.

Almost certainly it was Dowding who saw most clearly that, even if the Battle of France were lost, the UK could still be successfully defended if Fighter Command remained intact: on the other hand, as he put it in his famous letter of 16 May, if his fighter squadrons were to be frittered away in France, defeat in the Battle of Britain was inevitable. The final decision, however, did not lie with him: it lay with Churchill and the War Cabinet, closely advised by Newall and the newly appointed Secretary of State for Air, Sir Archibald Sinclair. Churchill, whose emotions could so easily sway his judgement, responded to French pressure by urging several times for more fighters to be sent, and it needed the firmness of Newall, well supported by his Chiefs of Staff colleagues and the other members of the War Cabinet, to ensure that the strategic realities were recognised. Eventually Churchill himself accepted that Britain had no option, and the final French pleas for more fighters were all firmly rejected: the decisive battle was not being fought in France, but would take place when Hitler turned the Luftwaffe against Britain.⁸

Reorganisation

So by the end of June 1940, Great Britain stood alone, supported only by her British Commonwealth partners. On the other hand the disasters in Norway, followed by those in the Low Countries and France, had prompted a new sense of realism, and the organisation for directing the war was now to be improved, and new men brought in. Churchill had become Prime Minister on 10 May, the day of the German attack in the West, and immediately he had reduced his War Cabinet to five members, taking

over the post of Minister of Defence himself, and established a small Defence Committee comprising the three Service Ministers and the three Chiefs of Staff. This Committee split its work into two areas (Operations and Supply); and at a slightly lower level the Chiefs of Staff Committee, which met several times a week, continued to deal with the professional matters relating to the three Services. The enormous amount of work entailed had already led in April 1940 to the establishment of three Vice Chiefs of Staff to handle the detailed departmental work, thus – in theory at least – leaving the Chiefs themselves to concentrate on major strategy and policy matters. There was now, therefore, a small, tightly-knit defence structure, whose various activities were co-ordinated and administered by the Chiefs of Staff Secretariat, headed by General Ismay; and within this structure Churchill was able to maintain very close day-to-day ties with his military chiefs.

For the RAF through the summer of 1940 these continued to be Newall and Peirse, who had been appointed Vice Chief of Air Staff (VCAS) in April, but on 14 May a major change was made when the research, development and production departments of the Air Ministry – hitherto the responsibility of Air Chief Marshal Sir Wilfrid Freeman on the Air Council – were detached to form a separate Ministry of Aircraft Production under Lord Beaverbrook. This enabled Newall and the Air Council to get on with running the Air Force and fighting the war, while the new Ministry could concentrate on the problems of organising and increasing the production of the necessary aircraft; but clearly there had to be close co-operation between the two Ministries, and not surprisingly problems arose from time to time, not least over the quantities of aircraft of different types that should be ordered.

The immediate challenge facing the RAF at this stage was, of course, the German air offensive against the United Kingdom, and – apart from the need to do something to meet the new Italian challenge in the Mediterranean – all its efforts were now devoted to winning the Battle of Britain. Once the immediate threat was past, however, and it became necessary to think about how the war might be fought in the longer term, the leadership of the RAF came under scrutiny. Newall, despite his many achievements, had been CAS since 1937, and was inevitably associated in many people's minds with the various shortcomings of the RAF that had been revealed in war – consequently, when Churchill decided to look for new blood he was among

the first to go. His successor, far younger, was Portal – ‘the accepted star of the Air Force’, as Churchill called him.⁹ An outstanding pilot in the First World War, he had later attended all the staff training courses, had been on the directing staff at the Imperial Defence College, and had served several times at the Air Ministry. He was thus a superbly qualified staff officer, and of all his talents as CAS, Sir Maurice Dean picks out the most important: he was in point of courage a match for Churchill, fully able to stand up to him when necessary – and he was immensely successful with the Americans in what eventually became a coalition war.¹⁰ From October 1940 until the end of the war Portal’s influence would dominate RAF policy.

Several other important changes occurred at about the same time. Portal’s place at Bomber Command (he had taken over from Ludlow-Hewitt there only six months earlier) was filled by Peirse; Peirse was succeeded as VCAS by Freeman; and at Fighter Command Dowding was replaced by Douglas. Thus a younger team was coming to the front, and only the departure of Dowding caused surprise. Embarrassingly senior to and increasingly remote from those he led, he had failed to deal with a serious dispute between his two main Group Commanders; as John Terraine remarks ‘the brilliant designer of battle had fallen down in the human area of command’.¹¹

Strategic Planning

The problems facing Portal and his team were immense, but already much thought had been given to the overall strategy to be followed. Responsibility for strategic plans rested with the Joint Planning Committee, comprising the Directors of Plans of the three Service Departments and answering directly to the Chiefs of Staff; indeed in August 1940 Churchill decreed that they should work directly for him as Minister of Defence, though in practice this made little difference. The RAF’s Director of Plans in 1940 was Slessor, who recalls in his memoirs working on the Future Strategy Appreciation in July 1940.¹² As he says, he and his colleagues could not possibly foresee the entry into the war of the Soviet Union and the USA, or even the advent of the Lend-Lease Programme, and their view of the future still resembled that previously agreed with the French. While the initial strategy would have to be largely defensive, allowing time to build up strength, increasing pressure must be put on Ger-

many by economic blockade and by air attack so as to weaken her resistance to the point at which a land force could eventually be re-established on the Continent. Meanwhile the Middle East would need to be reinforced and maritime strength increased. As one looks back this broad strategy grossly under-estimated Germany's war potential in relation to the resources Britain and the Commonwealth could bring to bear against her, and more specifically it failed to take proper account of the magnitude of the U-boat threat to Britain's sea communications. At the time, however, it seemed sound enough, and while it was never formally adopted as the basis for future planning its principles were generally accepted.

RAF Priorities

For the RAF this strategy meant that there were two primary roles: the air defence of the United Kingdom and the strategic bombing offensive against Germany. These were the two roles for which the Service had been preparing over the years, and while Bomber Command was far less ready than Fighter Command the heavy aircraft it would need were already on the stocks. Consequently, with Churchill and the War Cabinet firmly persuaded of the importance of taking the offensive in some way and seeing bombing as the only method open,¹³ the development and expansion of Bomber Command was established as the RAF's first priority in the earlier years of the war. Portal, of course, took no persuading of this, and through the difficult months of 1941, when it gradually became clear that the Command was achieving far less than had been hoped, he was its strongest advocate. Then in early 1942, when the bombing strategy was being widely challenged, he appointed Air Marshal Sir Arthur Harris to lead the campaign, a move which ensured that Bomber Command would play a key role for the rest of the war.¹⁴

Inevitably, however, the RAF's concentration of resources on the bomber force caused problems elsewhere, and not least in connection with the Battle of the Atlantic. As the U-boats were causing increasingly heavy losses among British merchant ships the Navy made a strong bid at the end of 1940 for the transfer of Coastal Command from the RAF; this was resisted by Portal,¹⁵ who agreed that the Navy should have operational control of the land-based aircraft, and thus laid the foundation for the

highly successful co-operation between Coastal Command and the Navy during the rest of the war.¹⁶ Even so, there was for a long time much competition with Bomber Command for scarce resources of aircraft, equipment and crews, and this was among the many subjects addressed by the Cabinet Anti-U-Boat Warfare Committee¹⁷ which was set up in November 1942 to co-ordinate all aspects of the planning and direction of the Battle of the Atlantic.¹⁸

The Army too was worried over the shortage of aircraft specifically allocated for its support, and in 1942, General Brooke, the Chief of the Imperial General Staff, proposed that a separate Army Air Arm be established. Once again Portal, a strong believer in the indivisibility of air power, insisted that unity must be preserved; merely to change the organisation would not produce more aircraft, and what mattered was that all the available aircraft should be allocated in accordance with the overall strategy.¹⁹ As with the Navy, the problem was eventually resolved by devising better methods of control and, of course, by the far greater number of aircraft that came eventually into service.

The questions of priorities in the earlier stages of the war arose not just in relation to the other two Services but also from the demands of different theatres of war. The Mediterranean posed the biggest problems in 1941 and 1942; the campaign first against the Italians and then against Rommel in North Africa caused a steadily increasing demand for aircraft of all types, and the RAF Headquarters in Cairo, commanded first by Longmore and then by Tedder, put constant pressure on the Air Ministry for reinforcements to be sent. The battles of Greece and Crete posed particular problems, for they had to be fought with the aircraft already in the theatre. The long Italian and German offensive against Malta was a further challenge, whose importance was recognised by the despatch of many much-needed fighter aircraft from the United Kingdom. Then, from June 1941 onwards, there were the insistent demands from the Soviet Union to be supplied with fighter aircraft – demands which Churchill felt bound to meet, but which seriously reduced the number of aircraft available elsewhere. And nowhere did the decision to send aircraft to Russia have worse consequences than in Malaya and Singapore, to which many of them would otherwise have gone. The increasing likelihood of a Japanese attack was a constant anxiety during 1941, but the more immediate pressures of the European war prevented Portal from send-

ing the necessary air reinforcements. As the official historian says of this time: 'Britain's resources were too small to meet all the many calls on them.'²⁰

The American Dimension

It was the entry into the war of the USA in December 1941 that changed the situation, though it must be stressed that well before that event the UK had been receiving American assistance of various kinds. As early as mid-1940 General Spaatz had visited London to establish contact with the RAF, and at the end of that year Slessor went to Washington to explain the RAF's expansion plans and to represent Portal at the first Anglo-US staff conversations, when it was agreed that – should the USA enter the war – the build-up of the bomber offensive would have high priority.²¹ Arrangements for the supply of American aircraft to the RAF under Lend-Lease were agreed at the same time.²² consequently, when the first joint meeting of the American and British Chiefs of Staff took place in Washington in December 1941 the RAF and the USAAF already had firm contacts, and Portal was quickly recognised by the Americans as a particularly skilful staff officer;²³ they were struck too by the fact that he had equal status with the other British Chiefs of Staff, whereas General Arnold had to defer to General Marshall.

It was this conference which instituted the new Anglo-American organisation known as the Combined Chiefs of Staff (CCS), answering directly to the two governments. The Chiefs themselves normally met only at the periodic major conferences, but the American Chiefs and the senior British representatives in Washington met much more frequently, and for the rest of the war the major problems of Allied strategy were dealt with at this level.^{24 25}

Perhaps the most important issue to be decided at this time was whether the European or the Far Eastern war was to have the priority. In the USA there were many who wished to concentrate the main effort against Japan, whereas in the UK, for obvious reasons, the defeat of Germany was seen as taking precedence. Yet at this point in time British strategy was being strongly criticised, largely because Bomber Command was absorbing enormous resources and achieving far poorer results than had been previously thought. With pressing demands for more RAF effort to be devoted to the Battle of the Atlantic, the

Mediterranean War, the new theatre in the Far East, and the preparations for the eventual invasion of North-West Europe, the continuance of the bomber offensive was now in doubt. On the other hand, Portal realised, the USA was hardly likely to give priority to the European War if the RAF were to halt its strategic bombing campaign – the USAAF, like the RAF, was a strong believer in the doctrine of the air offensive – and the decision in early 1942 to press on with the bombing of Germany was heavily influenced by the need to ensure that the USA was committed to the policy of 'Germany First'.

The Challenges of 1942

At the beginning of 1942, when the total shape of the war had at last become clear, the RAF's main expansion was well in hand. The aircraft that would dominate the remainder of the air war were coming into service, the training organisation – which relied heavily on the assistance of the Commonwealth countries²⁶ – was producing the necessary aircrew and support staff, and much of the infrastructure was in place. The Command and Group structure of the early days of the war had proved able to cope with the expansion with few major alterations, and the Air Ministry – though greatly enlarged – was still structured in the same way.

Moreover, the more acrimonious debates with the Navy and Army over the control of the air forces were over. The main changes in the command system that were now required related to joint operations with the other Services and with the Americans. Unfortunately, in the other area where co-operation was desirable, i.e. between the RAF and the Soviet Air Force, hardly anything worthwhile could be achieved; while the Soviets were prepared to receive aid in the form of aircraft and the occasional squadron to be based there, it was never possible to reach any understanding with them on significant operational matters.

It was in North Africa that the main developments took place during 1942. The campaign in Libya in 1941 had been marked by much misunderstanding between the three Services, a situation not made easier by shortage of resources and the disasters of Greece and Crete, and Portal took a close interest in the affairs of that theatre, where Tedder was not the RAF Commander-in-Chief, with Coningham leading the Desert Air Force. There was concern in London, with Churchill particularly critical, that the

RAF was not using its resources properly, and Tedder had to devote much time to explaining the situation, to reorganising his command, and to improving the understanding with the Army and Navy. At the same time Coningham was perfecting the arrangements for co-ordinating land-air operations, and by the end of 1942, at the Battle of El Alamein, Tedder's views were vindicated: 'In my opinion', he had written in 1941, 'sea, land and air operations in the Middle East Theatre are now so closely inter-related that effective coordination will only be possible if the campaign is considered and controlled as a combined operation in the full sense of that term.'²⁷

Thus by the end of 1942 two new concepts, as far as the RAF was concerned, had been proven in the Eastern Mediterranean, namely the unified control of all the air forces in the theatre and the role of a tactical air force in working in close harmony with the land forces. These concepts were now to be applied on a larger scale. As the main area of fighting moved in 1943 to the central Mediterranean, with the USAAF also becoming increasingly committed, it was decided at the Casablanca Conference to place all the air forces under one commander, who in turn would answer directly to the overall Allied Commander (General Eisenhower), and Tedder was appointed to the post of CinC Mediterranean Air Command. Then, a year later, this organisation having proved itself during the Sicilian and the early Italian campaigns, a similar structure was devised for Operation Overlord, and the principal leaders were transferred from Italy, including in the RAF's case Tedder and Coningham.

Casablanca therefore marked a turning-point. From now on the forces in the Mediterranean were under joint Anglo-American command, with officers of both nations working side by side, and ultimately taking their orders from the Combined Chiefs of Staff. For all day-to-day purposes, such as aircraft supply and maintenance, administration and personnel matters, the individual RAF staffs continued to rely on and answer to the Air Ministry in London; but their main operational directives came from the Joint Chiefs. It follows that for the rest of the war an increasing proportion of the time of Portal and his senior colleagues in London had to be devoted to the work of the Combined Chiefs of Staff Committee. Moreover, the emergence of the Joint Chiefs organisation helped to strengthen the position of the UK Chiefs of Staff Committee, who from now on effectively controlled the hierarchy of military sub-committees, and thus became themselves the decisive committee in the

making of British strategy, while the importance of the Defence Committee steadily declined.²⁸

Operation Overlord

The biggest preoccupation of the Combined Chiefs from now on was the preparations for the invasion of North-West Europe, to be known as Operation Overlord, and in this great enterprise air power would clearly play a key role. Air superiority needed to be won and maintained, and the sea and land operations would require air support of many types. For the RAF in the UK these operations entailed a major restructuring, based on the experience of the Desert Air Force, which had developed in North Africa the techniques of joint-Service warfare. The principle of unified command of all the forces to be directly engaged in the invasion required that the RAF and USAAF aircraft be placed under one Headquarters, designated HQ Allied Expeditionary Air Force, and Air Chief Marshal Leigh-Mallory, who had been CinC Fighter Command since November 1942 and was widely experienced in the air-defence and tactical support roles, was appointed as its commander, despite misgivings on the part of the Americans.²⁹ The RAF element, led by Coningham, was to be known as the Second Tactical Air Force, which would comprise several mobile Groups designed to work closely with specific elements of the land forces. Some of the squadrons required for this force came directly from the earlier Army Co-operation Command, but for a multi-purpose air force fighters and light/medium bombers were also needed: the former were transferred from Fighter Command,³⁰ and the latter were supplied by removing No 2 Group from Bomber Command.

Thus there was established in the UK for the first time a major formation which not only comprised all the aircraft needed for direct support of land forces, but also brought American and British Air Forces under unified command. This principle was not, however, extended to Coastal Command, whose operations would need to be closely associated with the invasion, but which still had major tasks elsewhere, or to Bomber Command and the US 8th Air Force. Over these strategic air forces, hitherto controlled by Portal himself on behalf of the CCS, there was much debate: both Harris and Spaatz believed that the best way in which their heavy bombers could support the invasion was by persisting with the strategic air offensive against Ger-

many, which was in their view likely very soon to bring about the collapse of her economy.³¹ On the other hand the Chiefs of Staff, strongly supported by Eisenhower, Tedder and the other senior invasion commanders, were convinced that the strategic bombers would have essential roles to play in the invasion campaign itself, and must be placed under the Supreme Commander. The protests of Harris and Spaatz were therefore over-ridden, and since it was not thought appropriate to place them under Leigh-Mallory they were made directly answerable to Tedder, the Deputy Supreme Commander, who had the task of co-ordinating the complete range of air operations. While this was not a particularly happy arrangement, such was the total weight of allied air power that the system worked, and the strategic air forces played major roles in the operations before D-Day and after it.

The Final Phase in Europe

The Second Tactical Air Force under Coningham remained in existence as part of the Allied Expeditionary Air Force (AEAF) for the rest of the war, its headquarters and formations moving forward as the battle area moved eastwards, and retaining close contacts with the land forces it was supporting. In September 1944, however, the British and US heavy bomber forces were handed back to the CCS, on whose behalf Portal exercised the overall control, and the strategic offensive against Germany, which had been continued on only a limited scale during the invasion period, was resumed at high intensity. On the British side there was now great debate about the form the attack should take. Portal, like the Americans, was persuaded that concentration on oil targets offered the best means of ensuring the rapid collapse of Germany, whereas Harris – never convinced of the value of ‘panacea’ targets – believed that the main weight of attack should continue to be mounted against the German economy as a whole, pleading that tactical considerations precluded concentration on one particular type of target. The debate was never fully resolved, and at one point Harris actually offered to resign. From hindsight it seems that Bomber Command, which was now capable of attacking precision targets with great accuracy, should have been used more as Portal wished; but, even so, Harris did devote much effort to the oil offensive, and he can hardly be blamed, as the operational

commander, for keeping in mind the need to vary the targets, confuse the defences, take account of the weather, and keep down the casualties.³²

The War in the Far East

Throughout 1942 and 1943 and indeed much of 1944, the Far Eastern War had had to take a low priority in the allocation of resources, and most of the RAF effort in India was directed towards defensive operations in the frontier area with Burma, and in building the necessary airfields and other facilities. The RAF command structure was similar in many ways to that in the Mediterranean theatre; the A.O.C.-in-C., Sir Richard Peirse for much of the time, was in charge of the complete air force, which had to maintain itself and carry out all the roles of air power; it had increasingly to operate in co-operation with USAAF formations based in the area for the support of China, and from October 1943 onwards it came under the overall direction of a Supreme Commander in the person of Mountbatten. Consequently, just as in Europe, while the RAF in the Far East was directed from the Air Ministry it had to operate within a strategy that was ultimately determined by the Combined Chiefs of Staff.

By mid-1944, with the end of the European War in sight, it was essential to allocate greater resources to the war against Japan. Churchill was determined that the United Kingdom should play a full and equal part in the liberation of Asia; as he wrote in his memoirs: 'What I feared most was that the USA would say in after years: We came to your help in Europe and you left us alone to finish off Japan.'³³ Much of this contribution was, of course, made in the Burma campaign, where the RAF operated in strength in support of the British 14th Army, with air transport as one of its key roles, but it was also decided in late 1944 to send forty squadrons of heavy bombers, to be known as Tiger Force, to operate with the USAAF in the direct air assault on Japan itself.³⁴ Planning for this force, to be based in Okinawa, was well in hand when the use of the atomic bomb brought the war to an end in August 1945.

Conclusion

Certain features stand out from this story. First is the contrast between the situation at the beginning of the war and that at the end. From a position where the RAF's activities were only loosely co-ordinated with those of the Navy and Army there grew a structure which enabled the policy and work of the three Services to be closely integrated. It was the same with the Alliances of which Britain was a member: whereas the Anglo-French Alliance in the early days lacked any effective command structure, the British and Americans developed a system that enabled their combined efforts to be properly applied to the various campaigns in which they were engaged, and nowhere was the co-operation closer than between the RAF and the USAAF. Not only was the strategy they followed jointly devised, but at times the air forces of one nation were placed under a commander of the other.

A third feature needs to be mentioned – one which is fundamental to an understanding of Allied leadership – namely, the committee system. This, while not new, was developed and strengthened under Churchill's leadership, and in due course adopted in part by the Americans, and its greatest strength lay in the principle insisted on by Churchill that the committees must combine the power to supervise with the capacity to act.³⁵ Consequently, through the various levels from the Cabinet, the Cabinet Defence Committee and the Chiefs of Staff Committee downwards, the machinery existed for the determination of strategy and its implementation, and, as Ehrman points out, one cannot overstress the influence of the Chiefs of Staff (Portal, Brooke and Cunningham) in the later years of the war as a collective team under Churchill, 'an influence over several difficult years such as no military commanders in Great Britain had exercised before'.³⁶ At the same time, as Ehrman goes on to remind us, the allied success in 1943–5 'bore witness not only to the ability of the commanders but to the unusual strength of the allied machinery for the central direction of the war'.³⁷

Notes

1. Group Captains Harris and Slessor both held the RAF Plans appointment during the 1930s: in 1936 Harris and his Navy and Army colleagues drew up a joint appreciation of the situation in the event of war with Germany which was shown by later events to have been remarkably perceptive.
2. N. H. Gibbs, *Grand Strategy, Vol. 1: Rearmament Policy*, London, 1976, p. 775. In *History of the Second World War*, United Kingdom Military Series.
3. *Ibid.*, p. 776.
4. Sir John Slessor, *The Central Blue*, London, 1956, p. 451.
5. *Ibid.*, p. 228.
6. Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive against Germany 1939-1945*, London, 1961, Vol. 1, p. 125.
7. Slessor, *The Central Blue*, p. 206.
8. Air Historical Branch Narrative, *The Campaign in France and the Low Countries*, p. 506 (AIR 41/21).
9. W. L. S. Churchill, *The Second World War, Vol. 2: Their Finest Hour*, London, 1949, p. 19.
10. Sir Maurice Dean, *The Royal Air Force and Two World Wars*, London, 1979, p. 308.
11. John Terraine, *The Right of the Line*, London, 1985, p. 205.
12. Slessor, *The Central Blue*, p. 304.
13. Churchill, *Their Finest Hour*, p. 405.
14. Portal also gave much encouragement to the Americans to build up their own bomber force and make the offensive a combined one.
15. Portal told Sinclair on 24 November 1940 that he and Freeman would resign on this issue if necessary.
16. Denis Richards, *Portal of Hungerford*, London, 1977, p. 200.
17. This Committee, chaired by the Prime Minister, included all the Ministers and Commanders directly concerned and also the key scientists.
18. M. Howard, *Grand Strategy, Vol. 4: August 1942-September 1943*, London, 1972, p. 302.
19. *Ibid.*, p. 205.
20. J. R. M. Butler, *Grand Strategy, Vol. 2: September 1939-June 1941*, London, 1957, p. 556.
21. Slessor, *The Central Blue*, p. 345.
22. It must be remembered that when the USA entered the war she needed to give priority to building up her own forces; consequently less aircraft, etc. were now available for the UK than had been expected.
23. Richards, *Portal*, p. 248.
24. J. M. A. Gwyer and J. R. M. Butler, *Grand Strategy, Vol. 3: June 1941-August 1942*, London, 1964, Pt I, p. 383.
25. Thus, for example, the general directive concerning the combined bomber offensive in 1943-44 emanated from the CCS meeting at Casablanca on 21 January 1943, and was passed to Harris at Bomber Command via the Air Ministry, and at the same time via the American staff to General Eaker at HQ 8th Air Force.
26. It must also be remembered that a very large number of the men who flew with the RAF and thus came under its direction were members of the

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Commonwealth Air Forces. Many more came from the occupied countries of Europe.

27. Lord Tedder, *With Prejudice*, London, 1966, p. 148.
28. J. Ehrman, *Grand Strategy*, Vol. 5: *August 1943–September 1944*, London, 1956, p. 18.
29. Terraine, *The Right of the Line*, p. 609.
30. The remaining fighter squadrons, i.e. those retained for home defence, were kept in a new formation known as Air Defence of Great Britain, and Fighter Command was abolished in November 1943. It was re-formed a year later.
31. Terraine, *The Right of the Line*, p. 608.
32. See the Harris–Portal correspondence, AIR 8/1020.
33. W. L. S. Churchill, *The Second World War*, Vol. 6: *Triumph and Tragedy*, London, 1954, p. 129–30.
34. Richards, *Portal*, p. 278.
35. J. Ehrman, *Grand Strategy*, Vol. 6: *October 1944–August 1945*, London, 1956, p. 318.
36. *Ibid.*, p. 327.
37. *Ibid.*, p. 361.

34

Commentary

Lee Kennett

In the chapters of this final Part the themes are air power, air policy and air leadership. The chapters have presented us with the experience of three of the Great Powers of the Second World War era, and, as chance would have it, all three powers were self-styled democracies. Are there common factors in their treatment of air power, factors which mark them apart from the totalitarian powers they faced? There are some serious problems here. In two of these democracies, while political leaders committed themselves to peaceable policies and a defensive military stance, military leaders were hard at work designing and building strategic bombing fleets, the most supremely offensive weapons of the Second World War. Professor Smith offers us a closely reasoned explanation of how this curious situation developed in Britain, taking us through all the turns and twists in political-military public relations.

Yet there are some obviously common problems which air power posed for Great Britain, France and the United States: in each country the air force was seeking a role and an identity. For the Royal Air Force the post-1918 period was one in which it had to struggle to maintain its independence, then struggle almost as hard for its share of military appropriations in the lean years of the 1930s.

For the *Armée de l'Air*, independence was achieved in the 1930s, after what General Robineau has so aptly called a 'War of Secession'. For the US Army Air Corps (Air Forces after 1941), there was no question of independence, but only of a sort of self-determination, in a struggle that had to be waged against both its parent, the United States Army, and – as General Huston reminds us – against the United States Navy as well.

In all three cases the air force ultimately found its role and its field of action, and in all three cases the solution was 'a syn-

thesis of compromises', to borrow another phrase from General Robineau – though the Royal Air Force compromised rather less than the other two air forces. Whatever the formula found, deep antagonisms remained between army and air leaders, these being papered over with vague phrases.

There are detectable nuances, if not outright differences, in the approach to air power and air policy. In France, all military doctrine and policy remained linked – one might say chained – to the French Army, which appeared to be the unique instrument for the nation's salvation in war. In Great Britain we can see through Professor Smith's paper the peculiar preoccupations of an island people. And the Americans have their peculiar traits too, first of all their cult of mass and size. General Arnold, when he had made the acquaintance of the Royal Air Force, remarked: 'Their idea of what was big, to us was little.' Then, too, the Americans were slow to profit from the experience of their Allies. They had to see and learn for themselves – sometimes at considerable cost – as when they probed deep into Germany with unescorted heavy bombers.

Then, too, what contrasts these fine chapters offer us in air leadership! We have a glimpse of almost sublime gifts in the decisions of the Royal Air Force leadership after the catastrophe of 1940: and we are shown tragic errors in leadership, as when General Denain decided that the Armée de l'Air would have to fight the Luftwaffe in 1935–6, and planned rearmament accordingly. When war did come four years later, the French Air Force had not recovered from that fatal decision. In Air Commodore Probert's paper we can see an RAF leadership which, after initial defeats and disappointments, is united and determined: the men who led the RAF were on the right road and they knew it. By contrast, General Huston offers us in his portrait of General Arnold a complex, intriguing figure. Arnold was a late convert to the doctrine of strategic bombing, and if he became a zealot, he was one haunted by lingering doubts. Arnold remains perhaps the most enigmatic of all the air leaders whose names have been evoked in this session, and one can only hope that a future biographer will resolve the enigma for us.

As I read these excellent chapters, I could not help but think again about the themes of this Part: air power, air policy, air leadership, and the decisions air leaders made – good and bad – in the period of the Second World War. And looking back to earlier Parts as well, it seemed to me that the real core of our story, the ultimate, basic element in all aviation history, is

something finite and tangible: the aeroplane itself. Air power, air policy, all strategic and tactical planning, should rest squarely on what the aeroplane can do, but in fact it rests on our perceptions of what the aeroplane can do. This distinction is an important one, and one we historians would do well to keep in mind: for while all doctrine rests upon the capabilities of weaponry, with the air weapon an accurate perception of those capabilities has been particularly difficult. Perception of the aeroplane has often been obscured or distorted by unrealistic and exaggerated expectations, by what could be called a 'fantasy factor'.

Today we board an aeroplane with no more thought than if it were a bus or coach, but fifty years ago this was not so. There was still something miraculous about flight, and about the machine that made it possible. There seemed no limit to what this miraculous machine might do in the future. To the man in the street the aeroplane certainly appeared to be a miraculous weapon: shortly after Pearl Harbor an opinion survey revealed that nearly half the American people believed the war could be won by air power alone. If the air weapon was miraculous, it was also terrifying, with an image of frightfulness that could have great impact on the public, and thus upon political leaders. Military leaders also recognised this image of frightfulness, and indeed played upon it for their own purposes. Professor Smith's chapter has shown this impact and this interplay very effectively in the case of Great Britain, and we learn from General Huston of an ambitious public-relations effort to 'sell' the American public on the war that the US Eighth Air Force was waging against Germany.

What is less commonly noted is that the 'fantasy factor', the tendency toward exaggerated expectations of air power, extended to political leaders. President Franklin D. Roosevelt sometimes harboured such expectations, for example, and one can only wonder whether General Arnold or other air leaders tried to disabuse their commander-in-chief. It is also possible to find this tendency among Allied military leaders; thus General Eisenhower and his chief ground commanders all wanted the British and American strategic bombing forces to play a major role in the Normandy invasion. These leaders had in a sense been 'sold' on the heavy bomber and its awesome destructiveness. The commanders of the Allied strategic bombing fleets were of a different opinion, for they knew the limits of their weapon and the ways it could not be used. But strategic bombers

did participate in Operation Overlord and the preparations for it – with generally indifferent results.

There is another aspect of this 'fantasy factor'. Did air leaders also run the risk of being misled by the allure of the weapons they wielded? Every fighter should believe in his weapon, but is it not true that those who fought in the air had the stronger belief? Strategic bombardment doctrine rested for years on little more than this sort of belief – or should we call it faith? That faith could sometimes cloud one's judgement. Well into the war some American air commanders, perhaps Arnold among them, felt that air power could bring about the fall of Hitler's empire with an invasion of the European continent.

There is a lesson here for historians. We need to keep in mind the fact that half a century ago the aeroplane was a cult object, a panacea, a scourge – in short a weapon to conjure with.

Concluding Remarks

Horst Boog

Although not all the topics envisaged originally could be dealt with, it is believed that even the limited number of subjects discussed helped to clarify some of the aspects of the conduct of the air war and to make some international comparisons. Above all, it has become clear that the geostrategic situation, the socio-political system, the top military and political echelons, the influence of the older services, the material resources and especially the industrial and economic management, capacities and manpower, plus the scientific capabilities, were the main factors in the determination of the kind and size of air forces set up by the most industrialised nations. Another insight is the marked difference between the way the war and air war was conducted by the militarised nations and by the democratic ones, which had become industrialised before them.

There is a striking similarity in the conduct of the air war in Germany and Japan, both militarised nations, although one of them was predominantly a land power and the other one a sea power. As their material situation was unsatisfactory, they started their wars in the vague hope that these would be of short duration, and when this was disproved they fought on relentlessly to the bitter end. In the armies and air forces of both countries military thinking and values prevailed, and operational matters and offensive thinking ranked on top, with defence, logistics, and the central control of resources and intelligence playing a lesser role. Admittedly there was a certain disdain of officers, for instance, towards intelligence in all the air forces before the war; but the fatal results of this neglect led to an improvement and reinforcement of the intelligence organisations in the democratic countries, while in other countries the low priority attached to it in comparison with offensive and operational thinking persisted despite an increase in personnel.

While the Germans and Japanese used up their air fleets in offensive operations at the perimeters of their zones of influence, leaving themselves with a shortage of fighters for the defence of their homelands at the end, they also neglected the development of radar as a means of intelligence during the offensive years until it was too late to make up for these shortcomings in the ensuing years of defence. The Germans and the British had reached about the same stage of radar development before the war. However, while the Germans concentrated on developing radio navigational aids for bomb target-finding in conformity with their offensive intentions, the British, expecting a German air offensive, continued to perfect their radar system for defensive purposes. This was also the case in the field of code-breaking, where the British employed incomparably more specialists than the Germans.

In Germany and Japan the services enjoyed far too much autonomy with regard to their armament. Parallel research and developments, along with a waste of time, labour and material was the consequence in those nations who considered themselves to be have-nots. Both excelled in over-estimating their own capabilities and fighting spirit and in underestimating and even despising their enemies – which provided them with sobering thoughts in their defeat. To a limited degree such mistakes were also committed elsewhere, as Professor Jones pointed out. So the RAF Bomber Command, dominated by offensive thinking and conscious of its offensive power, declined, at first, to take scientific advice. Only after the difficulties experienced in its strategic air offensive could no longer be denied did it seek the advice of the scientists. This confirms what David Kahn brought to our attention long ago, a fundamental psychological attitude that usually goes with offensive thinking, and that was also discernible in the general attitude of the Luftwaffe towards intelligence: the attacker has more confidence in his offensive striking power than in intelligence information about the defender, while the latter is very much interested in such information about the attacker.

It is interesting to find that in dictatorial regimes, where one might expect rigid planning and control of warfare and arms production, there was much less direction than in democratic nations. Mussolini hardly gave any directives on the conduct of the war, and long-range planning was as unknown in Italy as in Germany during the first years of the war. Nor was there any control of the economics of warfare by operations research. In

the organisational structure of the upper military echelons in Germany planning divisions were, with the exception of the office of the Director-General of Air Armament, practically non-existent. The planning undertaken in the early years of the war concerned battles, or campaigns at the utmost, at the level of military operations and strategy; so it was mostly handled by the operations officers (Ia/G3/A3) in addition to their daily business. There was no permanently institutionalised grand-strategic long-term planning board dealing systematically and comprehensively with all aspects of modern warfare—economy, technology, science, politics, propaganda, war production, manpower and operational military factors – and only after it was no longer possible to win the war were civilian experts increasingly called upon, especially in the fields of research and development and production.

Just looking at German and Anglo-American air-force records originating from the highest levels of command the researcher is struck by the external form, which already suggests a systematic procedure on the Anglo-Saxon side and a lack of it on the German side. The 'Führer' was soon planning and deciding questions of the conduct of air warfare after sporadic consultation with anybody at all or on the basis of his intuition, retaining his position as the ultimate arbiter. Goering copied Hitler's 'system' of dividing up responsibilities. Hitler preferred to base his decisions on his high-flown political, military and ideological objectives, and not on what was feasible with the available means.

However, for the conduct of a long war of attrition an overall direction based on a sort of Committee system with a steady flow of information from all the necessary staffs, institutions and offices, as described in Henry Probert's paper, would have been more suitable. Thus, in the Luftwaffe too the overall command was not based on the logistical possibilities but on the military and political objectives. Slighting logistics was a common phenomenon in all air forces, but nowhere more than in the Luftwaffe and in the Japanese air forces. Robert P. Smith described the logistical difficulties during the building up of the 8th US Army Air Force, but also stressed the endeavours made there for this reason. To overcome the separation of the supply system into an army and an air-force system was important not only with regard to the desired autonomy of the Army Air Forces but also with regard to the discrimination against the air force in sectors dealt with by the army. The latter problem also

existed in the German Air Force, which depended on the army for up to 80 per cent of its supplies.

Germany, France, Japan and curiously also the Soviet Union did not develop the whole spectrum of different kinds of air war such as strategic, tactical, coastal and so on. This can be attributed to the lack of resources and/or the geostrategic situation. These four air powers confined themselves instead to the co-operation type of air war with the army and navy, and did not attach much importance to strategic air warfare. That said, it is, of course, necessary to inquire into the meaning of air strategy to distinctly continental powers like Germany. It stands to reason that land powers could not but establish strong tactical air forces, because for them the land fronts were the most important ones. Nevertheless, there were great differences in the organisation of the tactical air forces. The French and the Soviets had their tactical air units tied closely to the army units when the war started, thereby prohibiting the concentration of the tactical air units at decisive points, and in turn stifling one of their most important capabilities. For the French this mistake had fatal consequences, which were meticulously illustrated by Michel Forget, because the 1940 campaign in the West was won by the Germans before the French Air Force could be reorganised. The Soviets learned a lot from their initial mistakes, as Von Hardesty illustrated, and they had the time to do so because they could trade space for time, which the French could not do for geographical reasons. They stuck to their static system of organisation, because they expected the enemy from one direction only. On the other hand, Germany's geographical position in Central Europe required high mobility and the ability to concentrate her air force at the decisive point. Mobility was established as early as 1938 by the separation of the territorial ground organisation from the operational units.

The Soviet Union was the first air power to commission long-range bombers in the 1930s, but with the exception of some sporadic operations, she avoided strategic air war. Certainly this was mainly due to her geostrategic situation as a land power, although great resources and the long distances to be overcome in this country should have been an incentive for the establishment and strategic use of a long-range bomber force. So we have to look still further for reasons to explain this abstention. Obviously, there were also shortcomings in training and navigation which prevented the strategic use of air power. Moral considerations sometimes adduced by Marxist historians were certainly

of no more consequence here than elsewhere in this respect, if we think of the favourable attitude to strategic and indiscriminate bombing expressed by Stalin in his correspondence with Churchill.

The Japanese were the first to extend the co-operation on land to the sea, by allocating land-aircraft to aircraft-carriers. They could thus by-pass the establishment of an expensive long-range bomber force. So the neutralisation of their aircraft-carriers was a main step to victory for the Americans. As for the British, John Terraine acknowledged the temporary justification of the strategic air offensive, but there is no doubt that he sympathised more with the tactical application of air power in support of ground and naval forces, which, he thinks, would have been of much greater use. Like the British, the Americans also tended to value strategic air war more highly than the co-operative employment of air power, and both had to learn co-operation in North Africa again the hard way.

It was mainly their geostrategic situation and their conviction that the bloody trench warfare of the First World War should never happen again that induced them to build up strong strategic bomber forces to envelop the land fronts through the third dimension and reach the heart of enemy countries, separated from their own by the sea, with fewer losses than in land battles. This attitude was reinforced by their realisation that their resources were almost inexhaustible, and by their long tradition as sea powers used to the application of the sea blockade as a legitimate means of warfare. The desire to avoid heavy losses in a land battle existed in Germany, too, but the weight of her geostrategic situation as a land power in the middle of the Continent and the shortage of resources necessary to sustain a usually prolonged strategic air offensive induced her to attribute a low priority to this kind of air war, and prepare instead for co-operative employment of her air power in the broadest sense.

Professor Jones stressed an important difference between militarised and democratic nations: the relationship of the military and civilian personnel. Had he, as head of the scientific intelligence section of the Royal Air Force, consented to being commissioned as an officer, he would have been integrated into the military hierarchy and been stripped of the freedom to disregard military channels of command and take up contact with those personages and offices he considered essential for the performance of his duties. In this way he could gather important information which might otherwise have been de-

layed or have escaped him because intermediate staffs might have considered it of no value and not included it in their reports. There was thus nothing to prevent him from talking to the most senior officers directly and taking proper measures immediately.

The situation was totally different for the engineers and scientists working for the Luftwaffe. Being civilians – though in uniform – they were for example excluded from test flights over the front lines, had no authority of command, and were subordinated to officers who were usually not well versed in technical matters. The attempt to make up for these shortcomings by establishing corps of engineer officers came too late in the war, and did not succeed for many reasons. The effect of this gulf between officers and civilians on the Luftwaffe's attempts to conduct a strategic air offensive in 1940–1 was that, in these decisive years of the war, and contrary to British and American practice, little use was made of the knowledge and experience of civilian experts and institutions in regard to target selection. Only in 1942–3, when the Luftwaffe tried to resume strategic bombing, were civilians, mainly from the Ministry of War Production, systematically included in the planning process.

While the Americans, faced with the necessity of a rapid expansion of the Army Air Forces and with a shortage of officers, commissioned civilian experts and managers as officers with the authority of command mainly in the fields of technology and logistics, and while, in England, scientists and various kinds of experts were earmarked even before the war for employment in the war effort commensurate with their abilities, for example, in laboratories, comparable German civilians were usually drafted as simple soldiers, if they had not had previous military training, and placed in the combat units, although their continued employment in scientific institutions would have been of greater benefit to the war effort. Only when it was too late to catch up with the Allied lead in centimetre-wave radar research were the experts called back to the laboratories. These few examples reflect – along with other miscalculations – some of the consequences of the militarisation of German society from the middle of the nineteenth century to 1945.

Of course, many things also went wrong in the British and American air forces. Terraine and Murray referred to the fact that even in the First World War the importance of continued fighting for, and securing of, air superiority by the fighter forces, as well as the telling effects of close air support, had become evident. But, as Terraine and Kennett have already

mentioned, the co-operative employment of air power had been neglected – though not totally – in the inter-war years in Britain and the United States.

Furthermore, the development of the escort fighter was considered to be an impossible task during these years, and until the middle of the war. There was, instead, the erroneous belief that heavy bombers flying in close formation were capable of defending themselves. But, as Holley's impressive account explains, it was mainly their rear defences which remained undeveloped in the inter-war years, ignoring the fact that fighters, as had been apparent since the First World War, usually attacked bombers from behind. The doctrine of the self-defending bomber formation was, therefore, not taken seriously enough in the development of defensive armament for US Army Air Force bombers. The British, like the Americans, first had to suffer great bomber losses, until they realised that the doctrine was wrong. Day bombers actually needed rear armament and protection by escort fighters. This should have been obvious from the First World War. It was the advent of the escort fighter in early 1944 that secured American air supremacy over Germany by day and thus initiated the Allied victory over the Luftwaffe. On the other hand, Goering knew the lessons of the First World War, and ordered the development of an escort fighter, eventually the Me 110, in 1938. However, this plane proved unsuited to its task, and had to be withdrawn from the Battle of Britain.

It is amazing to what extent the teachings of the First World War with regard to tactics, technology and war production had been forgotten in the meantime. Thus, Morrow concluded that the German air-armament industry during the First World War was better organised and activated than during the Second. In addition, the results of our own research as contained in Vol. 5.1 of *'Das Deutsche Reich und der Zweite Weltkrieg'*, ed. by Militärgeschichtliches Forschungsamt, indicate that the direction of war production and control of manpower were chaotic in Germany during the first two years of the war. The production increase in 1944 is only impressive if one disregards the kinds of products and what was no longer being produced. If, for instance, the dead-weight of the aircraft output of that year is taken as a basis for calculation, the production increase amounts to only 50 per cent of the 1941 output. The Soviet aircraft industry performed much better in view of the fact that it either lost many of its plants in European Russia or had to transfer a great number of them to Siberia.

In addition to the 'short-war' syndrome governing German strategy in the first years of the war, the causes of the comparatively low German aircraft-production rate in this period undoubtedly rested not only with the shortage of manpower but also with the military manner of directing the industry by command (*Befehls-, Kommandowirtschaft*), a method which did not take sufficient account of the laws and interdependence of technological and industrial production processes, and thus unwittingly helped to keep production figures low. Germany wanted to make the greatest possible use of modern technology; but the people in charge did not want to submit themselves to its laws, wanting instead to impose their will on it.

The Soviets, the British and the Americans took a much more rational approach to the problem of directing war production, and they were much more successful, not only because of the heavy punishments inflicted by Stalin for unnecessary changes and alterations during the production process, but also because they restricted their production, as the Americans did, to comparatively few types of aircraft. This contrasts strikingly with the multitude of aircraft types, variants and modifications permitted in the German aircraft industry.

German aviation research, despite pioneering individual results and although it had reached a very high level and compared very well with the research of the other air powers, could have been much more effective if it had not been hampered by its separation from combat experience at the fronts and by rigid directives for the safeguarding of secrecy in all spheres, which led to compartmentalisation of the institutions. The short-sighted neglect of modern development in favour of production, which was dictated in 1940 on the basis of the belief that the war would be short, delayed the development of modern aircraft.

Finally, the Soviets – with British and American aid – and the Western democracies and sea powers, where the social gulf between civilians and the military was not so pronounced as in Germany and Japan, and where the natural interest of entrepreneurs in profit was not stifled by government *dirigiste* policies, made a much better use of their economy than the other militarised nations.

Air policy in Europe and the Western world was greatly influenced by apocalyptic visions of the devastating effects of aerial bombing, which were even propagated for purposes of political blackmail or for reaching certain aims in domestic and military policy. In Germany the possibility of being bombed not

only confirmed the theory of total war; it also caused attempts to 'harden' the *Volksgemeinschaft* for total war by passive air-raid protection measures. Furthermore, it reinforced the offensive German air doctrine. Mindful of the collapse of 1918, the German civilian population was to be spared another bombing war by bombing the opponent first. The situation in Britain was roughly the same. It was thought that effective defence against mass bombing raids was impossible. There was a general fear of the knock-out blow inflicted on the capital at the beginning of a war, which was increased by the fear of an uprising of the population against the government and ruling classes, as happened in the Bolshevik Revolution of 1917. This, in turn, led to the conviction that such a fate could only be warded off by a powerful strategic bomber force bombing the enemy population first. The origins of this doctrine dated back to the German Zeppelin and Gotha raids of the First World War.

In this atmosphere it was almost miraculous that, as Wark mentions, a secret British report on the effectiveness of passive air-protection measures in Germany fostered the belief that a British bombing offensive would be useless and, together with economic considerations, caused British air strategists to implement a temporary increase in the production of fighters at the expense of bombers to meet the expected initial German knock-out blow. This measure, which was also based on the near-readiness of the radar defence system, proved to be decisive for the outcome of the war. It is interesting to note that an inveterate doctrine would be temporarily abandoned to Britain's advantage, while offensive thinking dominated German air doctrine even at a time when the efforts of the Luftwaffe should have long been switched over to the defence.

On the question of international law and the strategic bombing war there had been no progress between the First and the end of the Second World War. On the contrary, the latter more than the former revealed the quasi-lawless nature of this kind of warfare, even though there were a few rules of land and sea warfare which could be applied to the war in the air. The two positions were expressed in the papers by Parks and Messerschmidt, and the gap between the two was demonstrated by the fact that the pivotal point of Messerschmidt's argument, the so-called Martens' proviso – stipulating that, until a more complete code of the laws of war had been issued, the civilian population as well as the belligerents remained under the protection of existing international rules, humanitarian principles

and usages of civilised people and the dictates of public conscience – was not mentioned at all by Parks.

Obviously there were two conceptions of the international laws of the air war, an Anglo-American one which was based on an almost non-existent right as accorded by treaty and a continental view, which takes a declaration of intent in the preamble of the 1907 Hague Convention respecting the Laws and Customs of War on Land regarding humane treatment of civilians in war as a guideline, the one taking a more pragmatic and positivistic stand, the other a moralistic one. In his realistic analysis Parks shows that taking an ideological or a moralistic point of view towards bombing is perhaps too simplistic an approach. Moreover propaganda or wishful thinking should not be taken for facts. The crucial point of the whole bombing war was of course the fact that the industrialisation of modern war had obscured the dividing lines between military and civilian objectives, combatants and non-combatants and offered excuses for other intentions, and that no bomber force was able to drop its bombs exactly on targets of military relevance. Both claimed that such targets could be bombed even if they were located within civilian quarters. No doubt, humane considerations influenced British and German strategic bombing in the first year of the war, although British bombing doctrine aimed at breaking the morale of the enemy civilian population in the first place. But the longer the war lasted the more all the major air forces, for different reasons, engaged in indiscriminate bombing, a development that was encouraged by the above-mentioned blurring of dividing lines. The so-called necessities and urgencies of war dominated almost everywhere. Only post-Second World War development of air war law, electronic warfare and 'smart' weapons has brought us nearer to the ideal of 'clean' bombing, as shown in the Gulf War.

Great errors in the assessment of the enemy forces occurred in all intelligence branches of the belligerent air forces. The Germans underestimated the British, Soviet and American air forces and the Americans at first over-estimated the strength of the Luftwaffe and, thinking of the collapse of the German civilian population in 1918, underestimated their will to resist. The Japanese hardly took notice of the military strength and fighting power of their main opponents, because they felt superior to them. In the end all had to admit that they had deceived themselves at one time or another. But even when the intelligence services had taken true account of the facts, they could

not be sure that military commanders or political leaders were acting on their findings.

In some cases, such as the one exemplified by Sebastian Cox, it was even beneficial not to do so. In 1940-1, British air intelligence discovered the total ineffectiveness of Bomber Command's strategic air offensive against Germany, when Britain was still fighting alone. Had she, in recognition of the hopelessness of her situation at this time, sued for peace, she would have lost the war. So, at times, irrational decisions based on the will to survive can be better than taking rational measures in accordance with intelligence findings. But this is no recipe for a long war of attrition. Generally the British and Americans, in the latter years of the war, had a great advantage over the Axis powers and the Japanese because of the ability of their signal intelligence establishment to decrypt most of the enemy radio messages in time.

All air powers excelled in some fields or committed blunders in other fields of the direction of the air war, but the effects of each differed widely according to circumstances. Generally speaking, it can be said that the geographical situation and the lack of resources and time made mistakes fatal for the tripartite powers, while the anti-Hitler coalition, with its inexhaustible space and resources, could swallow mistakes better. In addition, their more rational approach to the air war, to the economy and to operations and strategy and, above all, their enormous production capacity proved to be of decisive advantage in the conduct of the air war, an air war which was unique and will probably never occur again in this way. It was only possible at a certain stage of industrial and aeronautical development – between the advent of the all-metal plane plus mass production and the invention of the ballistic missile and the atomic bomb. It was a phenomenon of a high degree of industrialisation in certain nations, who alone could afford to maintain masses of aircraft for the conduct of an air war. But it was also a question of mentality. Although Germany – and also Japan – was very far advanced in the industrialisation process, the mentality of the ruling classes was still very much influenced by pre-industrial thinking and values. This was reflected by stressing irrational rather than rational attitudes, and by subordinating politics to warfare. But wasn't it – as Lee Kennett points out in his fine commentary – also the air leaders of the big democracies who succumbed to irrational wishful thinking with respect to what the bomber could do? Nevertheless, if, as Richard J. Overy

observed, the war in the air in the Second World War was a test of modernity, then his other observation is also true: that the great democratic industrial powers stood the test better than the militarised dictatorships.

Much research still has to be done to explore the phenomenon of the air war from 1939 to 1945 fully. Many things the historian will never be able to reconstruct, since for instance the German Air Force destroyed most of its records at the end of the war. If this volume contributes to a better understanding of the air war as a form of contest between industrialised nations and, because of its comparative approach, to balanced judgements, and if it initiates further research on the subject, then it has fulfilled its purpose despite its incompleteness.

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